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ABSTRACT

This publication presents information and suggestions for providing adequate buildings and facilities for vocational agriculture/agribusiness education programs. Parts 1 and 2 are devoted to effective need assessment and long-range planning of the facilities on the basis of local comprehensive instructional programs. Part 3 addresses factors to consider in providing optimum building and facilities. The department layouts presented in part 4 are representative of vocational agriculture/agribusiness departments in Wisconsin. Plans are not intended as models but rather to show typical departments of various sizes that currently exist. Part 5 discusses facility features for various departmental areas. First are considered some general features to assure that the physical facilities will provide the teaching-learning environment conducive to quality education. Some apply to school buildings in general; others apply more directly to vocational agriculture/agribusiness educational facilities. Departmental areas for which facility features are specifically discussed include the classroom, office-conference room, locker and toilet facilities, general storage room, departmental laboratories, general agriculture/agribusiness laboratory, agricultural mechanics laboratory, greenhouse, and land laboratory. Part 6 briefly discusses effective building and facilities use. (YLB)

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Buildings AND Facilities FOR Vocational Agriculture/ Agribusiness Departments

U.S. DEPARTMENT OF HEALTH,
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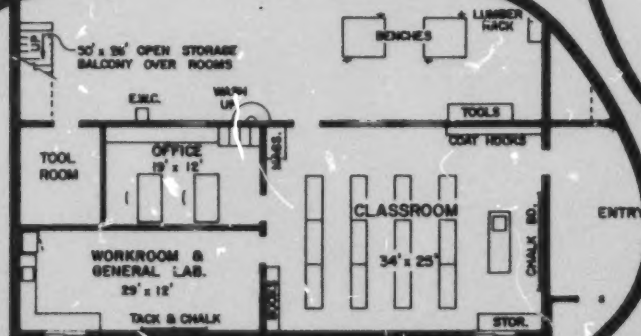
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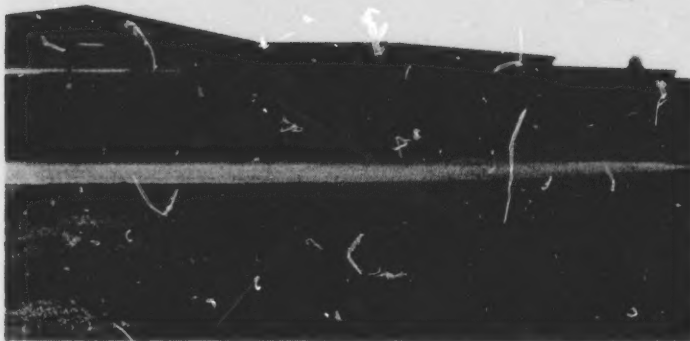
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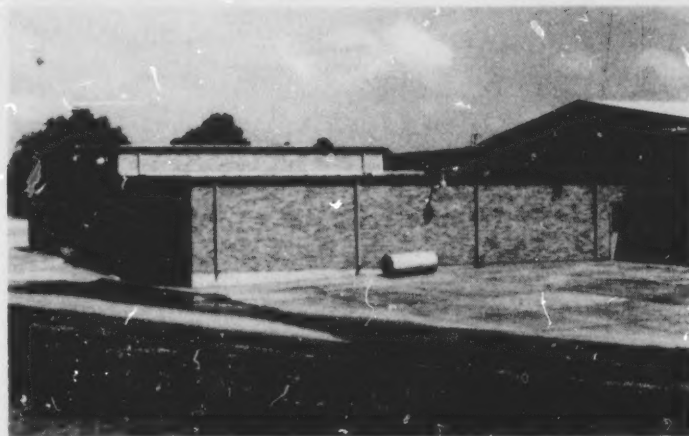


Departments of Continuing and Vocational
Education and Agricultural Engineering, College
of Agricultural and Life Sciences, University
of Wisconsin-Madison, and Bureau for Vocational
and Career Education, Wisconsin State Department
of Public Instruction

1980



Agriculture/Agribusiness departmental facilities are generally a part of the main school building. Adequate space is essential. A large overhead door and an auxiliary exit door are imperative. Adequate paved parking and outside work area are necessary.



PREFACE

This publication is designed to present information and suggestions for providing adequate buildings and facilities for vocational agriculture/agribusiness education programs. Considerable attention has been devoted to effective need assessment and long-range planning on the basis of local comprehensive instructional programs. In the State of Wisconsin, the Department of Industry, Labor, and Human Relations Administrative Codes for buildings and facilities and other official policies must be followed.

Suggestions in this document are not to be construed in any manner to be "policy" statements. Any person with responsibility for planning buildings and facilities should be certain that their state's building codes are being met entirely.

A local community undertaking a building program should be aware of existing policies pertaining to established minimum and recommended standards. Persons concerned should secure any available documents from state agencies which relate to planning and construction of buildings or maintenance criteria for vocational agriculture facilities.

Suggestions for optimum facilities, using examples of recently constructed vocational agriculture/agribusiness education facilities, resource references, and research regarding this problem are included. Illustrations included may help improve existing facilities as well as provide information regarding new construction. Attention has been given to helping one conceptualize departmental layouts from a planning point of view as well as seeing actual building layouts. Information is also provided about more extensive laboratory developments to enhance quality instruction. One should note that use of computers, land laboratories, and multiple instructor facilities needs careful planning.

Many vocational agriculture/agribusiness instructors in Wisconsin helped make this publication possible, including providing a number of photographs. Appreciation is extended to them and to the following persons who have contributed much in making worthwhile suggestions, reading the manuscript, and/or providing technical staff support:

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BUILDINGS AND FACILITIES FOR VOCATIONAL
AGRICULTURE/AGRIBUSINESS EDUCATION

by

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BUILDINGS AND FACILITIES FOR VOCATIONAL
AGRICULTURE/AGRIBUSINESS EDUCATION

PART I

NEED ASSESSMENT FOR BUILDINGS AND FACILITIES

Need For Buildings and Facilities

Assessment of need for buildings and facilities for vocational agriculture/agribusiness education should be a continuous process. School districts with existing buildings and facilities need to assess several factors: adequacy of existing facilities; relationship of current buildings and facilities to the nature of the curriculum and the educational objectives being sought for students; environmental aspects of present facilities, including modernization of lighting, safety features, accessibility to handicapped students, energy saving features; changing nature of students served, and the educational delivery system established or planned by the vocational agriculture instructors.

School districts planning new buildings and facilities should plan carefully in determining the need for new educational areas. Well planned, excellently designed, modern new buildings and facilities occur when careful need assessment and attention to emerging, as well as to current, curricular trends and student population projections are given.

Need for buildings and facilities for vocational agriculture/agribusiness education in the current educational environment might involve either:

Planning and construction of new facilities

Modernization of existing facilities

- Enlargement or expansion
- Improvement of features
- Modifications
- Additions

In any case, vocational agriculture/agribusiness instructors, school administrators, school boards, advisory committees, and community citizens share a responsibility, and have an opportunity in assessing the need for new educational facilities or in planning to modernize existing buildings.

Vocational education programs in agriculture/agribusiness are serving an ever-increasing diversified clientele. To achieve the basic program objectives for vocational and technical education in agriculture/agribusiness for students with varying experiences and educational backgrounds, there must exist a well planned and executed curriculum. Basic to effective learning and teaching in today's society, there should exist modern buildings and support facilities to help create the most optimum learning environment possible in which highly motivated

instructors might best function. Educational objectives, curriculum, buildings and facilities, interested student-learners, and motivated instructors are all interrelated and highly essential. In this context, the impact of well planned and efficiently constructed educational buildings and facilities on curriculum development and delivery should be readily recognized in the assessment of need for new and/or existing facilities.

NEEDS	+	WHAT IS TAUGHT	=	Prerequisite Considerations in
(Educational		(Curriculum)		Determining Need for Buildings
Objectives)				and Facilities

Agricultural trends, problems, and economic considerations point out the responsibility which educators, community citizens, supervisors, and administrators have in planning and in providing adequate modern facilities for vocational agriculture education's current and future needs. Widely expanding curricular areas in agribusiness and agricultural technology and mechanization imply that buildings, facilities, and educational delivery systems must parallel and keep abreast of scientific agricultural advances if competent instructors of vocational agriculture/agribusiness are to provide the most effective instruction to the increasingly diversified student clientele.

Adequate educational facilities, including classrooms and an increasing variety of learning laboratories both on and off campus, are vital parts of a sound educational program in agriculture/agribusiness. With the provision of optimum facilities comes a responsibility to provide an instructional program meeting the needs and problems of the people. Therefore, adequate need assessment and adequate planning and preparation of facilities and concerted attention to their effective use become absolutely imperative.

Importance of the Program Planning Process in Need Assessment

The determination of need for modernization of existing facilities or for planning new buildings and facilities and the actual planning for new departments of vocational agriculture education should be a well-coordinated, cooperative process. In the planning for new or existing facilities, one quickly recognizes that there are divergent, and sometimes competing, interests involved. How to best resolve these interests and still meet basic educational needs of the students to be served becomes a basic objective in the planning process.

Leaders in this cooperative process should be from the local community. There are many pertinent questions which must be asked and for which answers must be developed. How this is accomplished should involve a well-defined, recognized, and clearly understood program planning process.

The essence of the effectiveness of a program planning process in regard to providing buildings and facilities hinges on (1) making quality decisions, and (2) getting those decisions accepted by the school board and the citizens in the school district. Some of the factors related to these basic points are summarized in the following table:

TABLE I
PROVIDING QUALITY BUILDINGS AND FACILITIES
FOR VOCATIONAL AGRICULTURE/AGRIBUSINESS*

Program Planning Process Objectives	Success Based On	Product of	Suggested Actions or Approaches
1. Making Quality Decisions	Wisdom of participants Understanding of objectives Awareness of alternative solutions	Facts Knowledge of alternatives Intelligent consideration of facts and knowledge	Define problems and needs Get as many facts as possible Weigh and consider facts and alternatives
2. Getting Those Decisions Accepted and Implemented	Benefits to be derived Satisfaction of building and facility outcomes	Citizen involvement Participation in decision-making Personal determination Intention to act subsequently Freedom from misunderstanding and misconceptions Consent principle	Involve people in assessment of facts and alternatives Agree on alternatives Decide on "best" solutions Recommend to school board for action Implement actions which are approved

* Adapted concepts from: Norman R. F. Maier, Problem-Solving Discussions and Conferences: Leadership Methods and Skills, McGraw-Hill Book Company, Inc., New York. pp. 3-9; and Patrick G. Boyle, Problem-Solving Programming, University of Wisconsin-Madison and Extension. September, 1977. pp. 141-143.

Who Should Participate in Determining Needs?

The primary responsibility for determining the need for adequate buildings and facilities rests with the local school board. Others who should participate are:

1. Local School Administrators
2. Instructor(s) of Vocational Agriculture/Agribusiness
3. Citizen Committees interested in new or improved educational facilities
4. Local Advisory Committees
5. FFA Alumni
6. Students
7. Other interested groups served by the school system

In addition, suggestions may be sought from experienced consultants either within or outside the local school community. These resource persons who might materially aid the local community leaders include:

1. State Supervisors of Agricultural Education, State Department of Public Instruction
2. Safety and Buildings Division personnel, Wisconsin Department of Industry, Labor and Human Relations
3. Registered Architects and Professional Engineers
4. Building personnel representatives, State Department of Public Instruction
5. Agricultural Education staff members, The University of Wisconsin System
6. Neighboring Instructors of Vocational Agriculture/Agribusiness
7. Agricultural Engineering staff members, The University of Wisconsin System
8. Building Contractors
9. Professional Architectural and Engineering staff, The University of Wisconsin System

It would be well to remember that students for whom buildings and facilities are being planned might help clarify educational needs related to the community and region which would impact on the need for and the design of facilities. Staff members in the local school from related or associated fields can frequently make valuable observations and suggestions and should not be overlooked as sources of beneficial information. In summary, all valuable sources in determining building and facilities needs should be utilized as extensively as possible to assure inputs, support, and to avoid any obvious oversights.

When Should Needs Be Determined?

The earlier--the better--should be the goal in determining the real need for new and improved educational facilities for vocational agriculture/agribusiness.

Allow plenty of time for planning! Hasty planning can be expensive; plan before acting. Set up a timetable; make sure there are sufficient time intervals for proper understanding of building needs and for acquainting all individuals and citizens about specific needs.

If citizens, school board members, advisory committee members, school administrators, as well as instructors of vocational agriculture/agribusiness and students are a part of determining needs from the start, this will prove time saving in the long run. Their cooperative efforts will better assure approvals, funding, and general support throughout the total process of providing for new or renovated facilities.

How will Needs Be Determined?

Plan (1) carefully, (2) completely, (3) efficiently, and (4) cooperatively. To accomplish these goals requires diligent attention to concepts and philosophical considerations, size of buildings and facilities, design and environmental factors, and the equipping of campus classrooms and laboratories.

Consider:

1. Current and prospective enrollment based on population growth trends and shifts in educational choice
2. Nature of the curriculum predicated on an assessment of the educational needs, goals, and objectives for students and citizens who are to use the buildings and facilities
3. Concept of single versus multiple instructor department and the deliberative planning to design in flexibility; cooperative multiple-use possibilities, and sharing among and between related disciplines associated with vocational agriculture/agribusiness.

Persons responsible for determining building and facility needs should consider many important factors. It is extremely important to realize that the nature of buildings and facilities does indeed have an impact on curriculum design and delivery. For this reason, determining the long-range educational needs of students and making related curricular projections are absolute essentials.

Emphasis is increasingly being placed on broader curricula for vocational agriculture/agribusiness. This necessitates not only having conventional classroom and laboratory facilities but attention to the possible inclusion of: specialized campus laboratories for milk testing, soil testing, moisture determination; horticultural greenhouses and plant growth chambers; school forests; land laboratories; environmental laboratories; and utilization of other community resources in the educational program.

PART II

PLANNING THE FACILITIES

Cooperative planning, well in advance of actual needs, is important. Instructors of vocational agriculture and local administrators generally recognize early the need for improved facilities because of their closeness to the educational program. Usually, it is the instructor of vocational agriculture and/or the local administration that assumes the initial planning responsibility.

The following factors also need to be considered in determining building facility needs for vocational agriculture/agribusiness:

1. How complete a vocational agriculture/agribusiness educational program is offered or is to be provided by the school district or local community?
2. What are the present and anticipated enrollments, based on population projections and interest levels, in a complete vocational agriculture/agribusiness program in the community?
 - (a) Plan for the future as well as for current needs (estimate the size and number of anticipated classes and class modules and schedules)
 - (b) Consider any expected school district reorganization which will impact on size and type of building and facility needs
 - (c) Numbers of various education groups in a complete program
 - (d) Size (largest number of students within a given class) of different groups taught at a given time
 - (e) Agricultural (agribusiness) population of the school district served
3. What curriculums and services are provided or are planned? What is the educational program necessary to meet the needs and problems of those enrolled?
4. How much space is needed per student in the classroom laboratory, school agricultural mechanics laboratory, greenhouse facilities, and land laboratories?
 - (a) For students work area and study area?

- (b) For furniture and equipment?
 - (c) For additional facilities to implement the program planned?
 - (d) For special meetings of Future Farmers of America organization and combined organizational groups? (Don't overbuild if other community facilities might fulfill the need.)
5. What are the educational and agricultural objectives of the local program of vocational agriculture/agribusiness?
- (a) Facilities needed to attain these objectives
 - (b) Consideration of objectives for all age groups in agriculture/agribusiness
6. What financial resources are available for new building construction or for additions or improvements to existing structures?
- (a) Can financing be arranged?
 - (b) Consider "quality as well as quantity" of facilities
 - (c) Cost in relation to needs of other school facilities
7. What is the type of farming and agribusiness career opportunities in the community?
- (a) How will this affect facilities needed?
 - (b) Curriculum oriented to people as well as agriculture/agribusiness

Careful study, analyses and appraisal of the total needs of the community cannot be overemphasized. Well planned facilities result from deliberate action by planners to provide the best quality of instruction possible.

Let us now examine the planning process by three stages: early development, intermediate, and final planning.

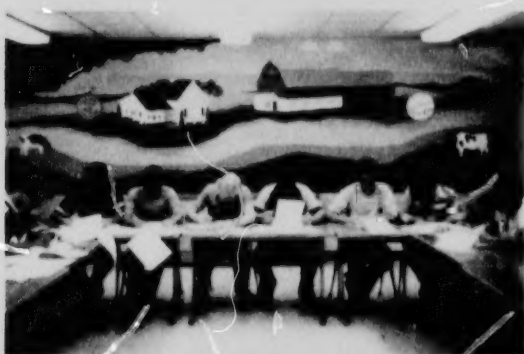
Early Developmental Planning

Assuming that the instructor of vocational agriculture has the initial leadership responsibility, the instructor should be aware of this responsibility in this early stage. There are many responsibilities which the instructor can assume after conferring with the school administration. The instructor should have enough time set aside from regular duties to assure that a good job is done. Travel funds should be allocated to help



Adequate facilities provide the environment for effective teaching/learning in vocational agriculture/agribusiness.

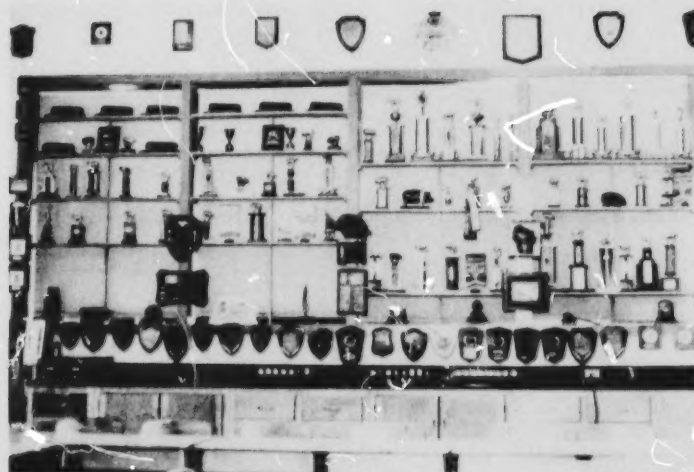
Multiple use of adjoining classrooms can be provided by folding doors which provide flexibility for larger group meetings of youth and adults,



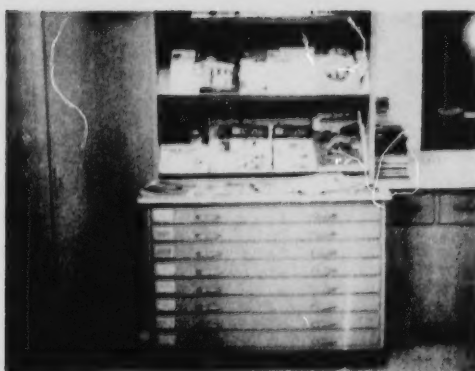
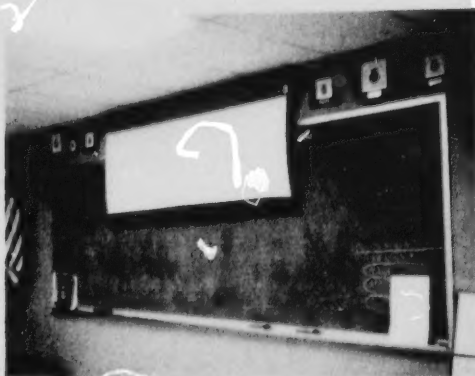
Classroom murals depicting agricultural settings can contribute to the learning environment. Movable tables and chairs help provide flexible classroom arrangements and provide more suitable work space.



A student can secure a notebook easily from this type of storage upon entering the classroom.



Awards earned in an active FFA Chapter can be displayed for others to see and to serve as motivation for students and members.



A retractable screen mounted over the chalkboard provides opportunity for effective visual presentations. Vertical drawers, horizontal drawers, or "flour bin" type storage are needed to store large charts and posters used in the instructional program.

implement the exploratory work: The small cost involved will pay large dividends in better building facilities later.

The agriculture/agribusiness instructor will (with any other designated persons):

1. Identify the magnitude of the production agriculture and agribusiness base in the community in terms of economic volume and employment opportunities.
2. Estimate the position of production agriculture and agribusiness, ten and twenty years in the future.
3. Compile population data for the area.

Age Range		Number of Individuals	Numbers Presently Served by Vo-Ag
Pre-school Youth			
Kindergarten			
Elementary School	Grade 1		
	Grade 2		
	Grade 3		
	Grade 4		
	Grade 5		
Middle School	Grade 6		
	Grade 7		
Junior High	Grade 8		
	Grade 9		
High School	Grade 10		
	Grade 11		
	Grade 12		

Tabulated information will provide a base from which to make projections on student numbers and facility needs. Persons making the projections

must be aware of and take in consideration such additional factors as:

- (a) In migration
- (b) Out migration
- (c) Agribusiness and industrial expansion in the area
- (d) Any special developments in the school that will affect the population data projection

4. Estimate the percent of youth needed to be served by a vocational agriculture program, and project that into the future.

Instructional Groupings	Present Situation		Projections			
	Number Indi- viduals	Number of Classes	Year Indi- viduals	Classes	Year Indi- viduals	Classes
High School						
Freshman						
Sophomore						
Junior						
Senior						
Special Classes						
a)						
b)						
c)						
Total						

The sources for the information on the present situation include school census, county census, and school records of enrollment. As projections are developed for potential clientele to be served, consideration must be given to the magnitude of the agribusiness

enterprise and its importance to the community. Planners must keep constantly aware of the career opportunities in agribusiness, and the responsibility of its school in preparing individuals for entry into these occupations.

5. Discuss the need for new or improved facilities with interested local people.
6. Collect materials regarding facilities for departments of vocational agriculture/agribusiness. These might include bulletins, articles, state codes, reference books, interview data and blueprints or drawings.
7. Visit departments with programs of recognized quality and consult with persons in these schools as to the adequacies and weaknesses of each facility. Make sketches of each facility, and make notes on significant observations.
8. Consult with supervisors, instructors, building engineers, and others to gain knowledge and insight which might be applied in local planning.
9. Arrange with the school administrators to present the departmental needs to the school board with supporting data gathered in the exploratory work.

If the local school board assumes a sympathetic stance regarding the facility needs presented, it is then time to move into the intermediate planning phase. This phase calls for more organizational structure and involves more people.

Intermediate Planning

It may be that a total school building facility needs to be evaluated and improvements planned, or it may be only the facilities for the vocational agriculture/agribusiness program. In any event, the school board should appoint a building committee. Members should include:

1. The local administrator
2. The agricultural instructor
3. A school board member
4. Local vocational coordinator
5. Farmer representative
6. Agribusiness representative
7. FFA alumni
8. Students

9. Others deemed necessary (i.e., a local community leader, not normally associated with the particular interest area, might help provide information to the community at large when needed.)

Such a committee should be given the responsibility to:

1. Study the objectives and long-range plans of the local program of vocational education in agriculture. Are these objectives appropriate for the community, are there other suggestions in the state's curriculum guide for agricultural education that should be included in the local program?
2. Review and discuss the materials gathered in the early planning phase.
3. Utilize appropriate resource persons.
4. Observe critically the departments with optimum level facilities and programs from the departments identified by the local agriculture instructor in the early planning phase.
5. Develop a preliminary statement of the facility, including size, characteristics, and costs with ways these costs might be met. Provision must be made for escalation of building costs due to inflation from planning stage to construction.
6. Plan a budget. A suggested form is given below:

Facility Costs	Amount	Source of Funds			
		Local Building Authority	State	Federal	Other
1. Land					
2. Architectural Fees					
3. Building Construction					
4. Auxiliary Fees (i.e., soil borings, legal)					
5. Equipment					
6. Maintenance (in re-occurring budget)					
7.					
8.					

In addition, consultants, such as local architects and builders, may be needed to provide technical information during the intermediate planning stage. They should be asked to give reactions to proposals considering sources of funding.

After thoroughly studying the alternatives involved in providing facilities for vocational agriculture/agribusiness, plans must be considered by the building committee and the school board. These plans should be reviewed critically. Keep a good record of all decisions made and suggestions agreed upon at each planning session. It is a sound policy to keep minutes and distribute to all committee members so that there is no confusion about any decisions.

Final Planning

When local representatives and school administrators have prepared programs, described functions and relationships, and defined spaces, a reliable architect should be engaged to help plan and design detailed plans. Creative designing to provide solutions for building needs is a basic responsibility for a competent architect.

In Wisconsin, the plans and specifications for every new building, or alteration to a building containing more than 50,000 cubic feet total volume, or addition to a building in which the volume of the addition results in the entire building containing more than 50,000 cubic feet by volume must have the plans and specifications for the design¹ of the building prepared by a Wisconsin registered architect or engineer. Before commencing work on the building, the supervising architect or engineer must submit plans and specifications² to the Department of Industry, Labor and Human Relations for approval.² Wisconsin statutes prohibit local issuance of construction permits for public buildings until³ drawings and calculations have been examined and approved by the department.

When the architect is preparing building plans, the local agricultural/agribusiness instructor should discuss with the architect the functions of each service area of the vocational department, i.e., classroom, laboratory. The instructor can indicate placement of built-in facilities, storage features desired for large charts and other teaching materials, placement of bulletin boards, electrical outlets, flexible wall storage for bulletins, books, and magazines. These and many other details can most economically be incorporated only if the architect is aware of special innovations and needs as the complete building is being designed.

-
1. Wisconsin Administrative Code, Section Ind. 50.07. Building and Heating, Ventilation and Air Conditioning Code, Department of Industry, Labor and Human Relations, Register. December, 1978, No. 276, p. 3.
 2. Ibid., Section Ind. 50.12, Part IV, "Plan Examination and Approval." p. 5.
 3. Ibid.

The time to make changes is during the planning stage, not at the construction stage. When the final plans are drawn, the school administration becomes engrossed in legal approval, financing, and awarding of bids. It is only then that the facilities can take form through the efforts of the builders who have been awarded the construction contract.

Plans should be filed with the State Department of Public Instruction for informational purposes.

Planning for adequate school facilities takes teamwork. The persons and groups included in the chart on the following page need to plan together for a vocational agriculture department that fits the needs of the community.

Check List For Planning the Facilities

In order to summarize the points made in this chapter in Planning the Facilities, and to give the planners a system for charting their progress, the following check list was developed.

	<u>When Accomplished</u>
I. Early Developmental Planning Phase.	
1. School administration recognizes a need and authorizes early planning.	_____
2. Vocational agriculture instructor (and others) are designated to secure background data.	_____
3. Identify agricultural production and agribusiness economic base in community.	_____
4. Projected age, production and agribusiness role for the school district.	_____
5. Compile population data.	_____
6. Estimate present and projected agricultural educational program needs.	_____
7. Contact interested local people	
a. Farm leaders	_____
b. Business leaders	_____
c. Bankers	_____
d. Representatives of the press	_____

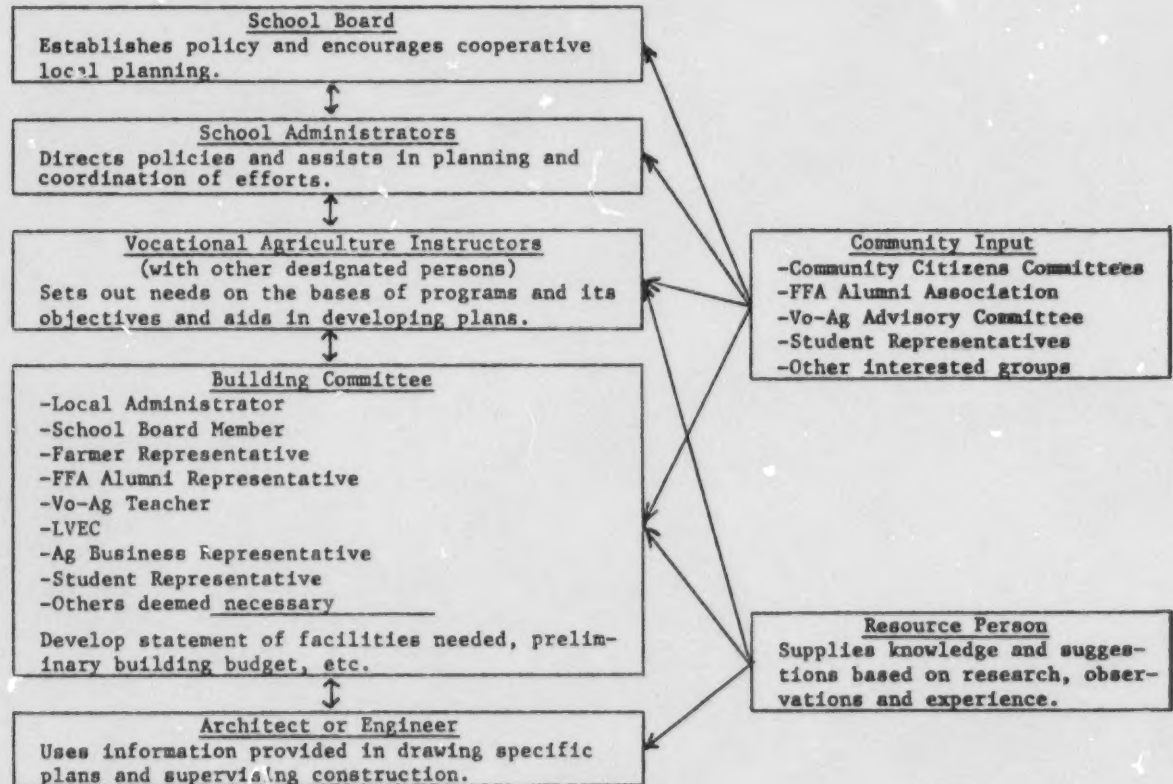
TEAMWORK IN PLANNING FACILITIES

Planning adequate school facilities should be a cooperative process involving responsible, informed, and interested persons and groups.

Early Developmental Planning

Intermediate Planning

Final Planning



Check List (cont.)

When
Accomplished

- | | |
|--|-------|
| e. Others | _____ |
| f. _____ | _____ |
| g. _____ | _____ |
| h. _____ | _____ |
| 8. Collection of written materials in vocational agriculture facilities. | _____ |
| 9. Visit to other vocational agriculture departments, develop sketches and take notes. | _____ |
| 10. Consult resource people from professional groups. | _____ |
| 11. Presentation of needs to local board of education. | _____ |

II. Intermediate Planning Phase.⁴

- | | |
|---|-------|
| 1. Board of Education appointment of a building committee with broad community representation. | _____ |
| 2. Committee study objectives and long-range plans for the local vocational agriculture/agribusiness program. | _____ |
| 3. Utilize appropriate resource people. | _____ |
| 4. Observe critically selected vocational agriculture facilities in other schools. | _____ |
| 5. Describe the facility needed. | _____ |
| 6. Develop a budget, including both anticipated costs and anticipated funding. | _____ |

-
4. An architect participating in several of these functions can be extremely helpful.

Check List (cont.)

When
Accomplished

III. Final Planning.

1. Agreement to proceed with building plans described by the building committee.
2. Employment of architect to design the building and prepare detailed plans.
3. Architect submit plans and specifications to the State Department of Industry, Labor and Human Relations for approval.
4. Certification in writing by supervising architect or engineer when structure is completed, that construction is in accord with plans and specifications previously approved.

PART III

FACTORS TO CONSIDER FOR ADEQUATE BUILDINGS AND FACILITIES

General Considerations

Many factors should be considered to provide optimum buildings and facilities for departments of vocational agriculture/agribusiness. Paramount consideration must always be given to the nature, breadth, and objectives of the educational program as reflected by the curriculum and its expected outcomes.

The probability of having efficiently integrated buildings and facilities depends on a variety of factors:

1. Adequacy of space as determined by curricular and program requirements.
2. Access to various units or areas within the building space.
3. The instructor's capability to supervise various study-work areas, e.g., strategic location of windows and doors.
4. Separate versus integrated building space within the total school plant.
5. Safety.
6. Building site.
7. Type and quality of construction.
8. Flexibility of facilities and space in general.
9. Availability of support utilities.
10. Environmental impact on students, considering adequacy of lighting, sound controls, ventilation, dust and gaseous pollution control.
11. Composite arrangement of entrances and of internal and external space areas as well as cohesiveness achieved with facilities and equipment.

Several of the above factors should be considered separately and in more detail.

Building Site

For a variety of reasons, it is most desirable that a department of vocational agriculture/agribusiness be an integrated part of a vocational wing or phase of the total educational physical plant. Ready access to the building area in times of weather (rain, snow, ice) is more easily accomplished in an integrated building than if a separate building is provided. Another basic consideration is that an integrated building facility partially helps eliminate a "separatism" between vocational and general education. Economics of building is another basic factor for consideration. There are several other pros and cons regarding separate versus integrated buildings. Those charged with the responsibility for a determination of separate versus integrated buildings and the impact on the building site as well as on the programmatic impact should be aware of the pros and cons.

Integrated Buildings

Pros

1. Easier access during inclement weather--distance factor as well as covered passage ways.
2. Helps eliminate "separatism" between vocational and general education.
3. Integrated and shared-use concept easier with other vocational type programs.
4. Building for vocational agriculture harmonizes with main school building.
5. Heating, lighting, water, etc. utilities efficiently and economically provided.
6. Contact among teaching staff in total school easier to establish and maintain.

Cons

1. Noise disturbance and control for agricultural laboratory more difficult.

Separate Buildings

Pros

1. Future building expansion more easily accomplished.
2. Less noise disturbance from the agricultural mechanics laboratory.
3. Greater flexibility in use of adjacent external space.
4. Adjacent parking to main entrance for handicapped students can be easily provided.
5. Vocational agriculture buildings, including greenhouse, laboratories, etc. can be fully integrated.
6. Outdoor storage of large machines and equipment can be more easily provided.

Cons

1. Utility costs may be higher than if in an integrated school building.

Integrated Buildings

Cons (cont.)

2. Adjacent work space (external) to agricultural mechanics laboratory might be more limited.
3. Future expansion may be more limited.
4. Parking space adjacent to entrance may be more limited.
5. Provisions may still need to be made for an attached or a separate building for a greenhouse or horticultural center.

Separate Buildings

Cons (cont.)

2. Separatism of students and teaching staff more likely to occur.
3. Student movement time between classes is generally increased.
4. Interaction with school administrators and other vocational instructors may be lessened.

Most departments of vocational agriculture are located in the main school building.¹ Building site, therefore, is influenced by the total school building more than by a separate singular instructional building and facilities. Several factors should be considered, however, in reference to the building site:

1. The vocational agriculture/agribusiness department should be located on the ground level, and if possible, should be convenient to public entrances.
2. Easy access for handicapped students and the public should be provided. As mandated by the Architectural Barrier Act of 1968, (PL90-480), any building constructed or altered using federal dollars or a federal grant or loan must be architecturally barrier-free.² The building site might, therefore, affect access, and, if so, might create a barrier or undue negative impact on a handicapped person with physical disabilities. Compliance with Section 504 of The Rehabilitation Act of 1973 is also essential.

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1. Donald Schwarz, "Wisconsin Farm Shop Survey." B.S. Seminar Report, Department of Agricultural and Extension Education, University of Wisconsin, Madison, 1955. p. 19. Approximately two-thirds of the departments in Wisconsin were integrated within the main school building. In some states many more departments are housed in separate buildings.
 2. Wisconsin Administrative Code, Section Ind. 52.04. Building and Heating, Ventilating and Air Conditioning Code. December, 1978, No. 276, p. 82. This stipulates that all public buildings and places of employment shall be accessible and usable by all citizens including any persons with functional limitations caused by impairments of sight, hearing, incoordination, perception, semiambulatory or nonambulatory disabilities.

3. The classroom(s), office and conference room(s), general laboratory room(s), agricultural mechanics laboratory, horticultural-greenhouse center, and any auxiliary rooms and space should be incorporated into one integrated composite unit.
4. Proximity and availability of land laboratories, greenhouses, school forests, etc., dependent on community needs and curricular priorities and emphasis, should be as physically close to other buildings provided to the department of vocational agriculture as possible. Consideration must be given, however, to other factors such as: drainage, soil runoff, landscaping, soil fertility, and type of available land, transportation availability and time, storage of equipment at the site of any outdoor laboratories, supervisory capability of instructors when distance between the primary building site and the site of the land laboratory becomes too extensive. More use than ever is being made of land laboratories to provide students learning-work experience in nursery management, orchard production, vegetable growing, turf management, plant propagation between the greenhouse and field conditions, ornamental horticulture, floriculture and farm forestry.
5. Environmental impact on use of the building site, particularly areas adjacent to the main school buildings and the total school grounds campus, must be given appropriate consideration.
6. Classrooms or laboratories, desirably, should be at grade level.
7. Sufficient adjacent parking space should be accessible to the department entrances for the physically disabled and for adult school patrons and others. Such spaces designated for parking should be at least twelve feet wide.
8. Separate entrances to the agricultural departmental facilities are generally desirable to facilitate visits to the department by adult farmers and enrolled students, especially during summer when the main school entrances might be locked. Frequently, agricultural products and equipment are brought into the department for instructional purposes, making separate (and larger) entrances desirable, and, in some instances, essential.
9. Building the agricultural mechanics laboratory, if the building site permits, as an L or T-shaped wing to the main school building often helps reduce noise. The agricultural mechanics laboratory should definitely be on the ground level to provide easy access for heavy equipment and to allow for a level entrance to the building, with an adjacent storage and parking area, since a level area is safer than steep inclines.

10. A building location should allow for good surface drainage, adequate drives, walks, and parking areas. Drive layouts should be located to reduce the probability of large numbers of students having to cross drives. Basically, drives should be placed to reduce as many hazards as possible for school students in the vicinity.
11. Desirably, the site should allow for a surfaced work area adjacent to the agricultural mechanics laboratory. Such areas serve as auxiliary work space for machinery repair and maintenance instruction and for demonstrational areas.
12. In relation to the total school building site, attention should be given to the most efficient installation and maintenance of utilities, i.e., electrical, telephone, sewer and water.
13. Environmental compatibility with the total buildings and the surrounding areas should be considered in site selection, i.e., reduction of pollution, visual enhancement, auditory controls, and air quality.
14. Site developments, landscape, and architectural design of buildings should be considered jointly.
15. If animals are to be present, careful attention to waste removal systems is essential. This may require consultation with sewage districts to meet their criteria.

Type and Quality of Construction

A budget-minded community should seek the most functional, durable, and attractive type of construction, yet be certain that the quality of construction is not sacrificed at any time. Frequently, it is desirable that new facilities or additions to existing facilities be in harmony with existing architecture. This factor alone may predetermine the type and quality of construction. Local economic conditions in the building industry, including availability and cost of building materials, may be the ultimate determinant in controlling building materials used for building. A variety of building materials is available generally. Architects, generally, can provide valuable advice about alternative building materials as well as design features which might be considered. It must be recognized, however, that architects might not have general awareness of the broad programmatic needs in agriculture/agribusiness. For this reason, the vocational agriculture/agribusiness instructor must play a valuable role in acquainting the architect about the agricultural education program and its relationship to building design, layout, and equipment needs and arrangement. These factors should be stated clearly in the building program presented to the architect, prior to his/her commencing work on the project.

The design and type of building do affect utility and effectiveness of the instructional program. They also affect economy. Poorly designed buildings, while they might be less expensive, but not necessarily, might end up being less useful, or might create problems. For example, observation capability by an instructor may be designed into a building without additional cost, yet the supervisory ability of an instructor is affected greatly by room relationships and window placement.

Construction costs must be studied in relation to their effect on the architectural design and utility of facilities. Costs should be calculated on the basis of:

1. Normal enrollment capacity.
2. Cost per square foot of construction.
 - (a) Gross square feet
 - (b) Net assignable square feet (the useable square feet, that is, the area programmed for use, as prepared by the committee.
3. Cost per student.
4. Pro-rata life of facilities.

Original cost estimates on the basis of cost per gross and/or net assignable square feet might well reveal high construction costs. However, a logical way to study construction costs is to divide initial cost figures by the normal life of facilities, and by adding in maintenance estimates, to reveal annual cost estimates. When this approach is followed, quality construction most likely will be the goal.

Space Requirements

Space requirements for a department of vocational agriculture/agribusiness will depend on several factors previously recognized, including:

1. The number of persons enrolled in the respective instructional phases of the educational program.
2. The breadth of the local educational program--current, planned, and anticipated for the future.
3. Areas sufficient for equipment, projects, machines, etc., in addition to optimum space for students using the facilities.
4. Areas sufficient to provide safety zones and free floor space. Crowded areas are usually less safe areas.
5. State and/or federal codes which stipulate space requirements for students, for varying instructional functions, for equipment, and for safety. Adequate space for circulation of the disabled within the instructional areas is essential.

6. Single-instructor versus multiple-instructor departments (based heavily on program breadth and student enrollments).
7. Concept of single-use versus shared-use space, intradepartmental as well as interdepartmental.

Efficient planning for space should consider (a) adequate space for the future, and (b) flexibility of space use as well as the present enrollments in the program. General recommendations for space needs are made later on the basis of space per student, space for equipment, and space for various functional areas (agricultural mechanics laboratory, classroom, general laboratories, horticultural greenhouses). For most any department, an outside work area adjacent to the main agricultural mechanics laboratory entrance will add utility to and supplement work areas within the permanent building without unduly adding to construction costs.

In assessing space requirements, one should study carefully a shared space concept, particularly for multiple-instructor departments (intra-departmental space utilization) as well as for interdepartmental use common service areas with other vocational departments within the school.

With greater specialization in the teaching function and with large enrollments necessitating multiple-instructor departments, considering the combined or shared-space concept during the early planning stage could affect substantially the space requirements of the vocational agriculture/agribusiness department. If space is provided for each instructor, and the program areas for that person, as if no other instructors were in the department, space needs would be much greater than if the combined or shared-space concept among multiple-instructors is the approach. Compatibility of functions and of instructors is a must for intra-departmental shared space utilization.

For the combined or shared-space concept to result in a harmonious operation among multiple-instructors, there is a need for all concerned to be cognizant of several points and factors:

1. Combined space must be sufficiently large enough and physically arranged to allow for proper instructor supervision and for adequate instructor-student individualized counseling and conferences.
 2. The curricular offerings, course phase sequencing and manipulation of space (the sequencing of space utilization) should be pre-planned, coordinated carefully, and jointly agreed upon in advance by the
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3. Stallsmith, Douglas D., Guidelines for Planning Industrial Education Facilities and Equipment, Bulletin No. 9167. Wisconsin Department of Public Instruction. 1977. pp. 41-62.

instructors involved. In such circumstances, the willingness to work together on a cooperative basis is paramount.

3. A careful assessment of combined space needs suitable for the type of learning activities to be involved should be made at the outset.
4. There should be an agreed upon plan for resolving simultaneous space needs to reduce the possibility of conflicts arising among instructors. This should involve some criteria involving educational priorities, a clear and concise communication system, and a recording of resolutions to avoid future misunderstandings.
5. Sequential utilization of intra-departmentally combined use of space can best be accomplished if one thinks of (a) compartmentalization of functions as well as of space, (b) flexible structural features which provide maximum modification of the combined space use, e.g., folding room dividers, sliding panels, and (c) "flow" of functions which suggests ways and means for rotation of one instructional group from one area to another, followed by still another instructional group.
6. Space without structural barriers is easiest to adapt to combined-shared use by multiple-instructors since it can be utilized for many functions without being encumbered by physical structures.

Special attention should be given to multiple-shared use of space wherever there is a multiple-instructor department. For multiple-instructor departments⁴ there is a real need to:

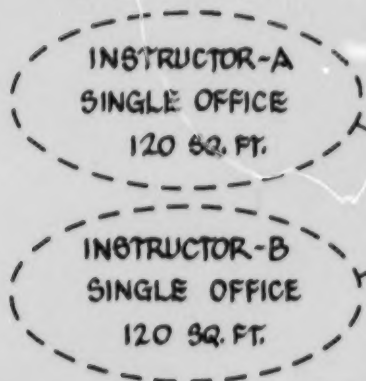
1. Decide on whether space will be provided separately for each instructor as if each was in a single-instructor departmental status.
2. Recognize the pros and cons of combined-shared space provided.
3. Decide at the outset courses of study, curriculum format, and the compatibility of facilities and curriculum.
4. Designate one instructor as departmental chairperson who is charged with the responsibilities of coordination and administration, yet having mutually agreed upon principles and policies for program operations.

4. Oates, John D. and Deeds, Jacquelyn. Policies and Procedures Handbook for Oregon Vocational Agriculture Programs. Department of Agricultural Education, Oregon State University, Corvallis, Oregon. March, 1978. pp. 14, 35-38.

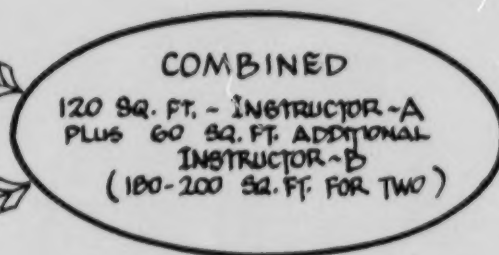
ILLUSTRATION OF COMBINED-SHARED SPACE UTILIZATION CONCEPT

OFFICE CONFERENCE ROOM

SINGLE INSTRUCTOR APPROACH

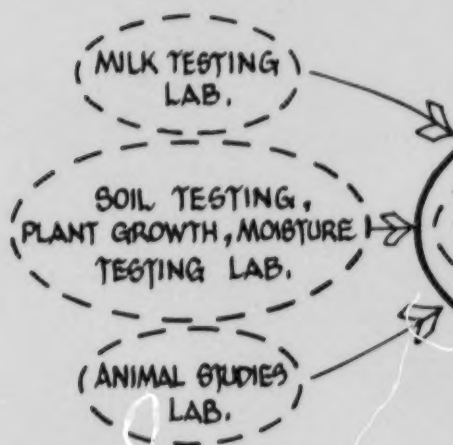


SHARED SPACE APPROACH

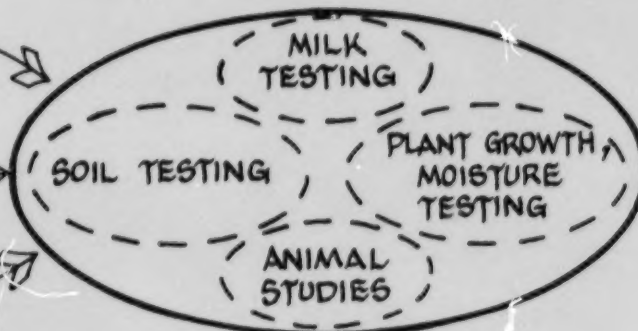


LABORATORIES

SINGLE FUNCTION APPROACH



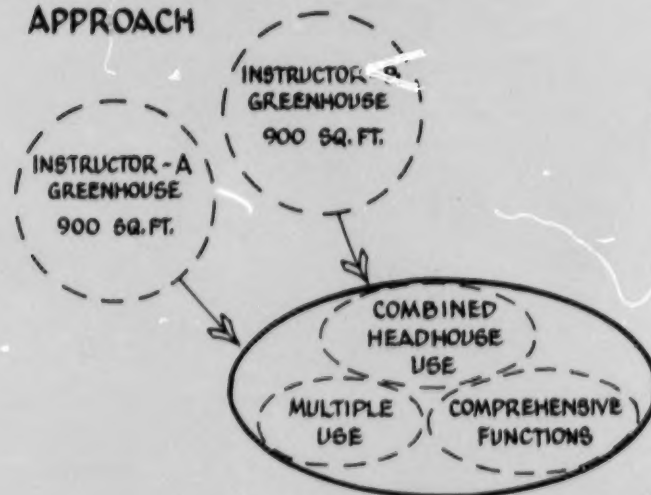
INTEGRATED / MULTIPLE FUNCTION APPROACH



FUNCTIONAL AREAS
WITHIN LARGER AREAS

PLANT SCIENCE / HORTICULTURE GREENHOUSE

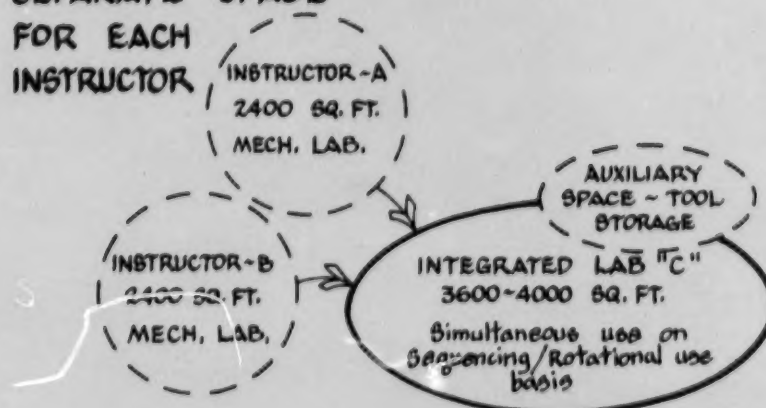
SINGLE INSTRUCTOR APPROACH



MULTIPLE INSTRUCTOR APPROACH

AGRICULTURAL MECHANICS LABORATORY

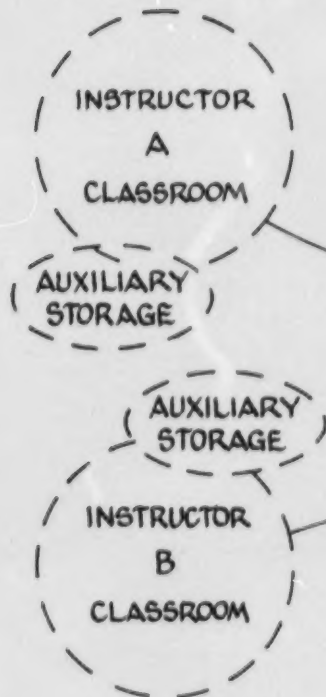
SEPARATE SPACE FOR EACH INSTRUCTOR



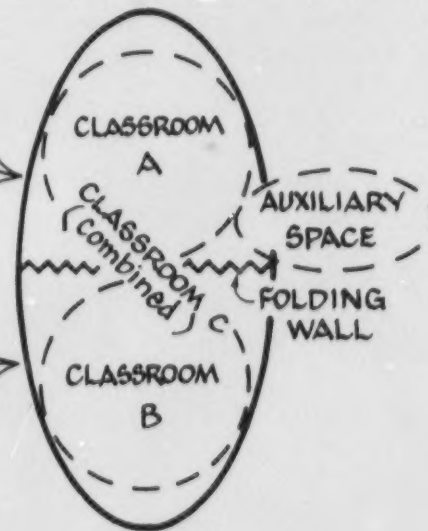
COMPREHENSIVE COMBINED SPACE

CLASSROOM And AUXILIARY SPACE

SINGLE INSTRUCTOR APPROACH



MULTIPLE INSTRUCTOR COMBINED SPACE APPROACH



Note: Classroom "C" combined will allow for folding wall or sliding panels to separate classroom A from B for normal single class utilization. It will also provide an extra large classroom for holding Chapter FFA meetings involving several combined classes, for adult education programs, or for team teaching extra-large classes. Sharing of common service or auxiliary space is possible, and several related program activities and functions can thus be accommodated.

5. Have a basis for resolving space needs and utilization and the extent to which the concept of combined-shared space will be utilized.

General recommendations for space needs are made later on the basis of space per student and space for various functions as well as for equipment. Efficient planning for space should consider adequate space for the future as well as for present program needs.

Flexibility of Space and Facilities

All departmental facilities should be included in a unit with as much flexibility as possible. If future expansion is planned, or becomes imperative, the structural design of the building should make provision for this possibility. Emphasis within the local educational program might gradually change. There, some degree of space/facility flexibility is highly desirable. Flexibility can be achieved by a variety of means, including:

1. Clear span construction, recognizing that costs increase with span distance and that where multi-story construction is considered, long spans do become expensive.
2. Movable equipment
3. Adjustable built-in facilities
4. Maximum "open space"

A good test for flexibility of facilities is to answer the question: "Will the facilities meet the present and the future expected educational demands of agriculture/agribusiness in this community?"

Safety

Arrangements of facilities, placement of equipment and furniture, color conditioning, lighting, ventilation, access, heating, sanitation, guards, fire proofing, safety education, obstructions and barriers, and many other factors affect total safety of individuals. Careful attention should be given to reducing the possibility and probability of an accident or injury. Not the least important of these factors is the provision of adequate space for the maximum number of individuals simultaneously using the facilities. Crowded conditions contribute to higher incidence of accidents, to interference of orderly learning-work experiences, and to increase disciplinary possibilities.

While the teaching of safety is highly essential, facility planners must give adequate thought to providing:

<u>Safety Item or Point</u> ⁵	<u>Key Factor</u>	<u>Check List</u>
1. Work space	Adequate for safe operation of every machine	_____
2. Floors, passageways	Free from obstructions, non-slip surfaces	_____
3. Areas around equipment	Free from obstructions, non-slip surfaces	_____
4. Platforms or 24" high surfaces	Guardrails must be provided	_____
5. Pulleys, flywheels, etc.	Adequately guarded	_____
6. Stairways or steps	Uniform rise of not more than 7"; tread not less than 9"; handrails to be provided	_____
7. Jointers, bandsaws, radial arm saws, sanders	Guarded properly	_____
8. Storage of combustible materials	Meet state industrial codes for various materials	_____
9. Eye protection	Provide in any area where hazards may be expected to cause eye injury; e.g., flying particles, injurious gases, fumes, and liquids; injurious radiant energy--properly fitted goggles, etc.	_____
10. Adequate air exchange	Meet industrial code standards	_____

Usefulness and Adequacy of Space

The usefulness and adequacy of space and facilities are influenced by the proximity of the department to other building areas, the internal arrangement of rooms and work areas, the relationship of outside work areas to the agricultural mechanics laboratory, and functional flexibility to

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5. Wisconsin Administrative Code, Ind. 1.01, Safety. April, 1972, No. 196, 39 pages. In Wisconsin, safety requirements and regulations as stipulated by the Department of Industry, Labor and Human Relations must be met. Individuals are encouraged to study additional safety regulations by referring to Wisconsin Administrative Code, Ind. 1000-2000, Safety and Health. September 1, 1975. No. 236, pages 327.

meet various teaching situations. A test of usefulness or utility is: "How efficient are the planned facilities likely to be?"

The scope and size of the instructional program, the number of students, and related services will determine if facilities are adequate. For example, a comprehensive laboratory program involving soil testing, moisture testing of grains, plant germination studies, animal studies, as well as milk testing, and laboratory demonstrational teaching will require more space than if only a limited laboratory program is contemplated. It is wise to plan for a comprehensive program. The scope and relative emphasis in the agricultural production/agribusiness curriculum for the clientele served determine the adequacy of any facilities.

Provision for Support Utilities

Effective teaching in vocational agriculture/agribusiness generally incorporates a wide-range of educational activities in production agriculture/agribusiness. Adequate support utilities and services are necessary for efficient program operations. Typical utilities which must be provided include:

1. Electrical service for all facilities--with special wiring in the agricultural mechanics laboratory for welders and large equipment motors.
2. Telephone service to the vocational agricultural office--frequent calls from local farmers and professional people throughout the area make this service a necessity. (Some additional communication outlets may serve small computer terminals through telephone lines.)
3. Gas for heating in the laboratory and for forging in the agricultural mechanics laboratory, if available and desired.
4. School inter-communication system to keep the agricultural instructor and students informed of school plans, programs and policies.
5. Water service to the general laboratory, agricultural mechanics laboratory and wash room.
6. Audio-visual capability in classrooms and adequate protected storage for cataloging and storage of a variety of audio-visual aids.
7. Dictating-transcribing-duplicating service.

Additional information about heating, ventilation and lighting details are provided in Part V.

PART IV

DEPARTMENT LAYOUTS

The following plans are representative of vocational agriculture/agribusiness departments in Wisconsin. In some instances, plans have been modified or adapted to help better illustrate concepts contained in this document. These plans are not presented as models but rather to show typical departments of various sizes that currently exist. Before analyzing any particular plan, it would be wise to read the section on "Computing Space Needed", as found in Part V.

Plans included in the publication may be divided into three categories:

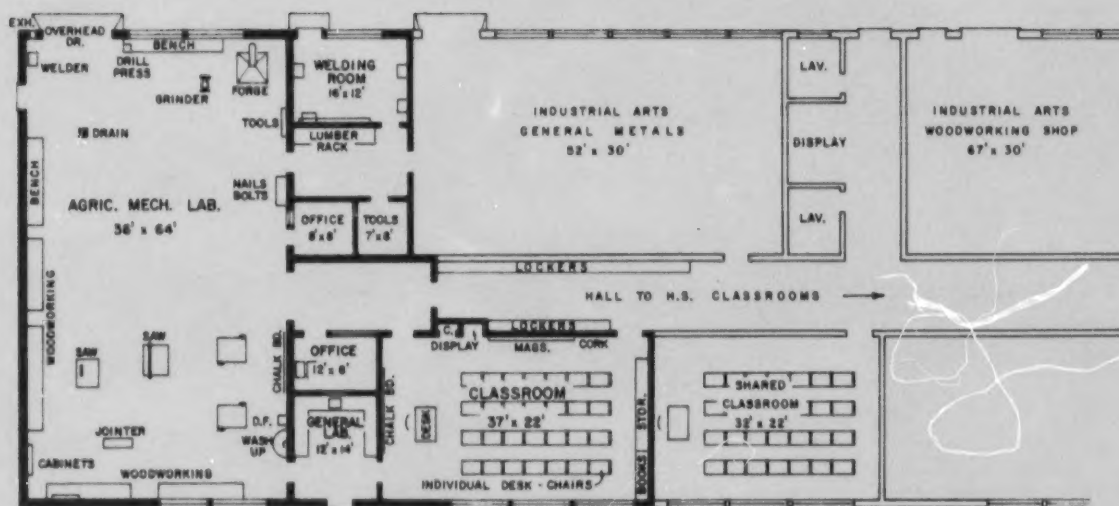
1. Facilities for smaller enrollments
2. Facilities for average-size enrollments
3. Facilities for multiple-instructor departments

Some department facilities are relatively new and thus are not fully equipped or organized. Due to funding restrictions and budget limitations, considerable time may be needed to secure the necessary equipment in the various laboratories.

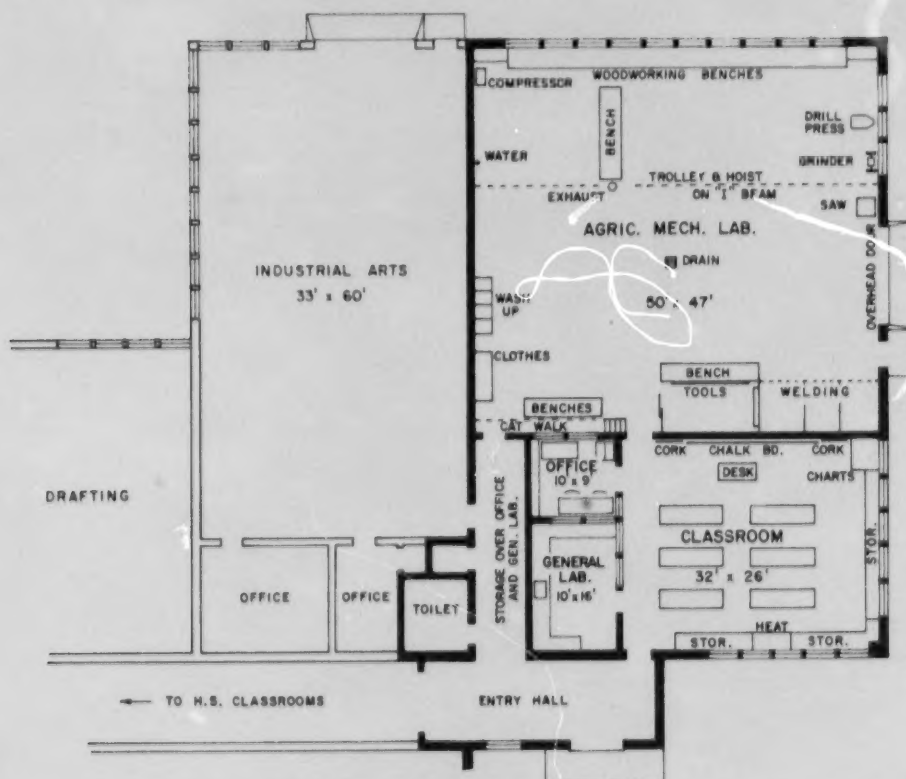
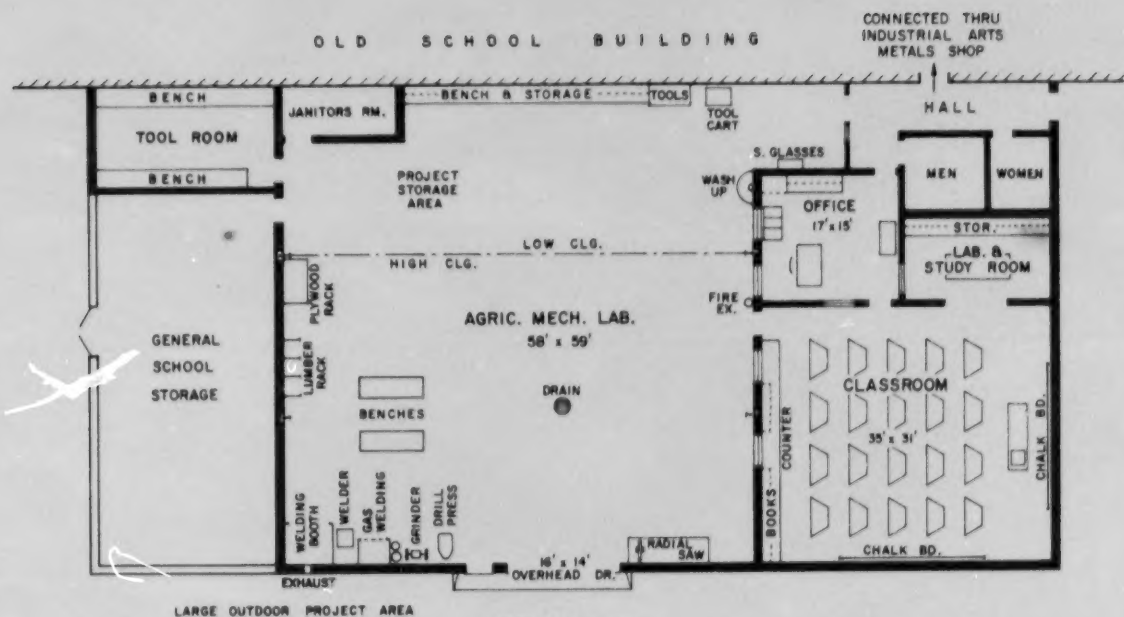
Several departments are additions to existing schools. This may impose restrictions which would not surface if a completely new facility were constructed. Since greenhouses are recent additions to many department facilities, they are usually located some distance from the classroom and agricultural mechanics laboratory. Although this may cause some inconvenience in some instances, the addition of this laboratory enriches the total program of vocational agriculture/agribusiness, and thus is welcomed in an increasing number of departments.

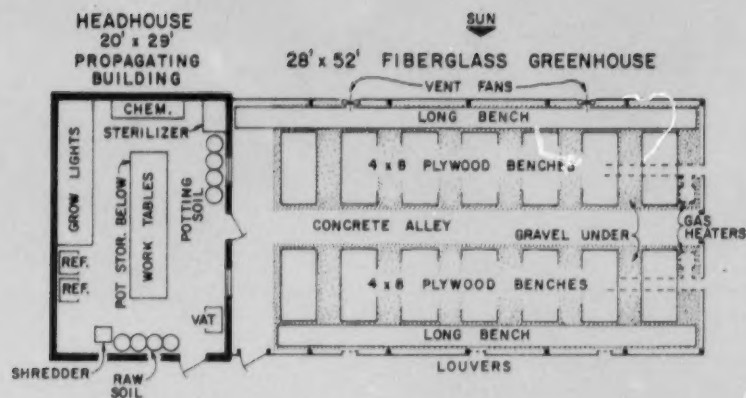
It will be valuable to study these plans carefully for their desirable features. Studying how these features can be incorporated into the local plan will lessen costly errors during the construction stage, and will contribute to increased efficiency of use in the years ahead.

In several plans, facilities beyond the vocational agriculture/agribusiness department are shown. Adjacent facilities, when feasible, may be used jointly (share-space concept) with other vocational disciplines as an economy measure, and in most instances result in greater use and more relevant learning.

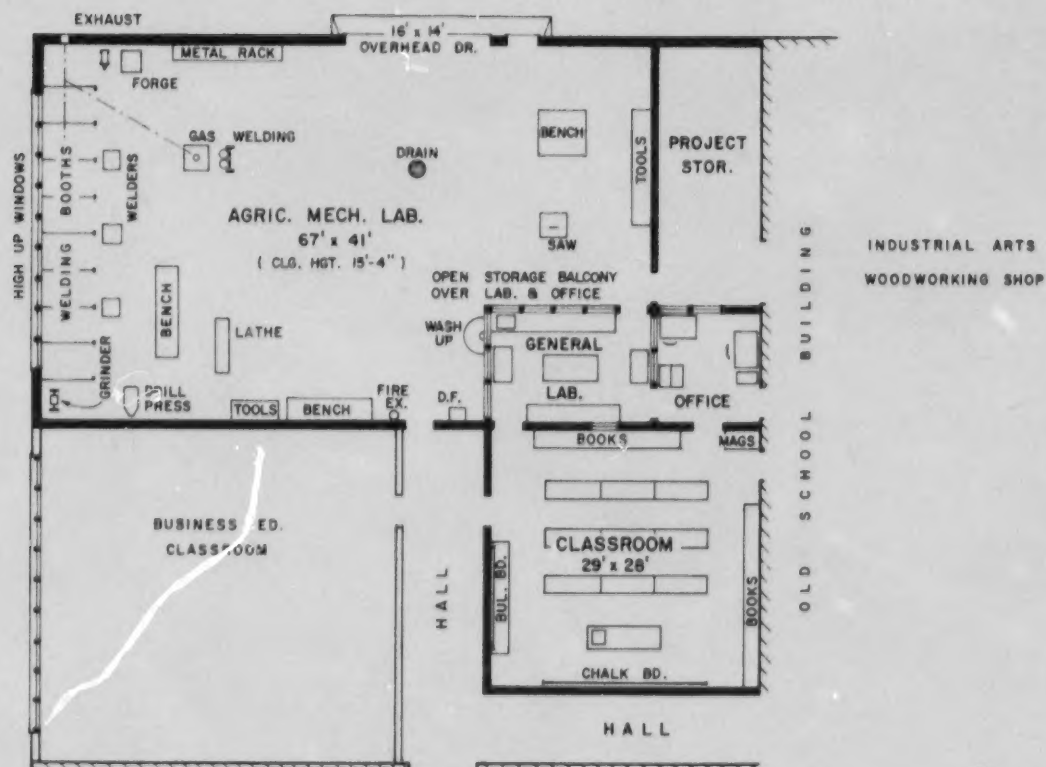


MULTIPLE INSTRUCTOR
VOCATIONAL AGRICULTURE DEPARTMENT RICE LAKE HIGH SCHOOL

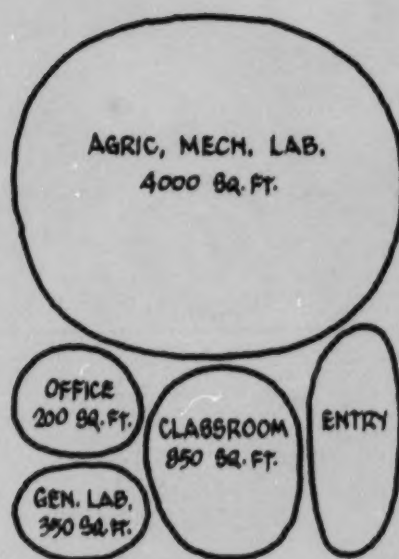




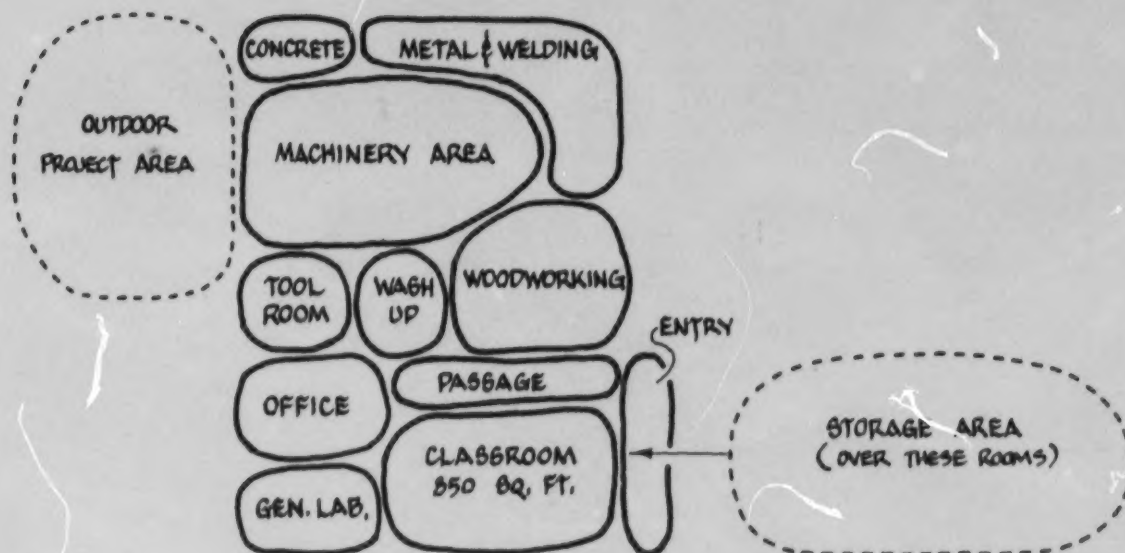
HORTICULTURE VO. AG. FACILITY VERONA HIGH SCHOOL



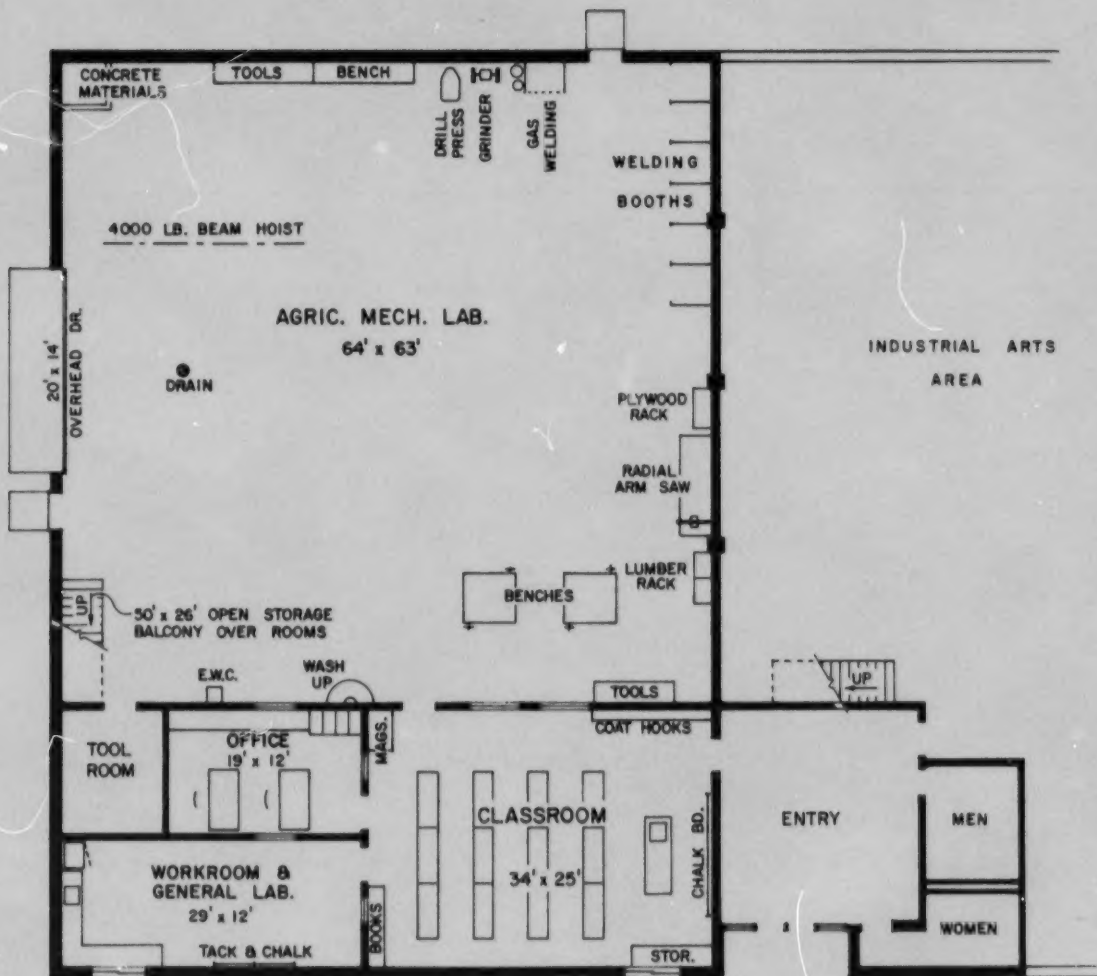
VOCATIONAL AGRICULTURE DEPARTMENT HIGHLAND HIGH SCHOOL
(PLAN SLIGHTLY REVISED)



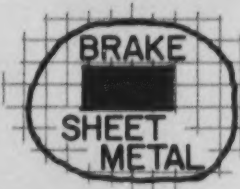
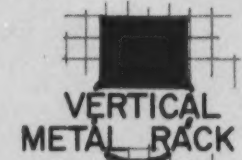
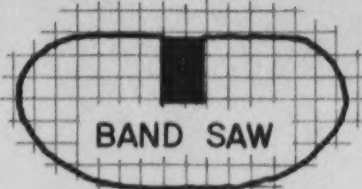
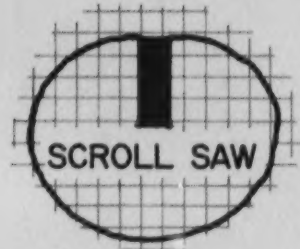
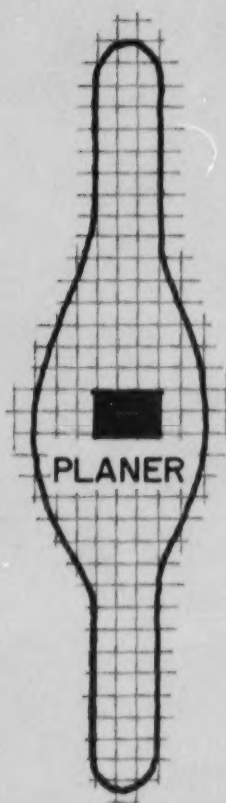
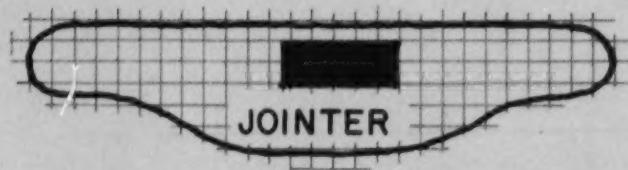
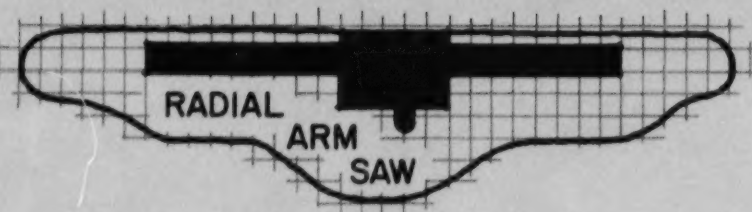
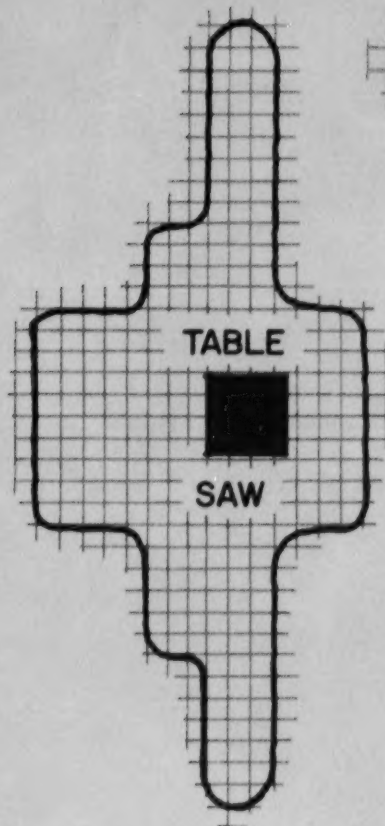
"GOOSE EGG" PLANNING SKETCH
(LODI FACILITY)



"GOOSE EGG" SKETCH WITH MORE DETAIL
(LODI FACILITY)



ADAPTED FROM - VOCATIONAL AGRICULTURE
DEPARTMENT LODI HIGH SCHOOL



PART V

FACILITY FEATURES FOR VARIOUS DEPARTMENTAL AREAS

General Physical Features

Several general features need attention to assure that the physical facilities will provide the teaching-learning environment conducive to quality education. Some features apply to school buildings in general, whereas others apply more directly to vocational agriculture/agribusiness educational facilities. Heating, lighting, ventilation, decoration-painting and space determination are some general features which should be considered.

Basic to the facility development is the overriding issue of adequacy, utility, efficiency, and adaptability of space for each educational function or activity. To determine adequacy of basic space, one must eventually establish a base for determination of gross floor space versus usable floor space. By knowing the maximum number of individuals to be taught or to be involved in an educational function or activity, and by knowing the minimal space per individual, one can readily compute the essential space for a department. One should recognize that there is a considerable difference, in some instances due to a variety of factors, between gross square feet of space in a building versus net assignable (or usable) square feet of space. Net assignable square feet is of primary importance.

Computing Space Needed There are two important aspects about floor space per student for any educational area, e.g., classroom, agricultural mechanics laboratory. These two aspects are: (1) MINIMUM FLOOR SPACE PER STUDENT, and (2) OPTIMUM FLOOR SPACE PER STUDENT. Desirably, a public school should strive to provide OPTIMUM FLOOR SPACE PER STUDENT for several reasons:

Crowded Space Contributes To:	Optimum Space Provides For:
1. Greater safety problems	1. Safer teaching-learning environment
2. Lesser control of students	2. Safer work areas and work zones
3. Disciplinary problem probability	3. Easier movement of persons, equipment, machinery from one area to another
4. Smaller safety work zones around equipment, machinery	4. More demonstrational teaching areas
5. Lesser demonstrational areas for effective teaching	5. Better storage of auxiliary materials

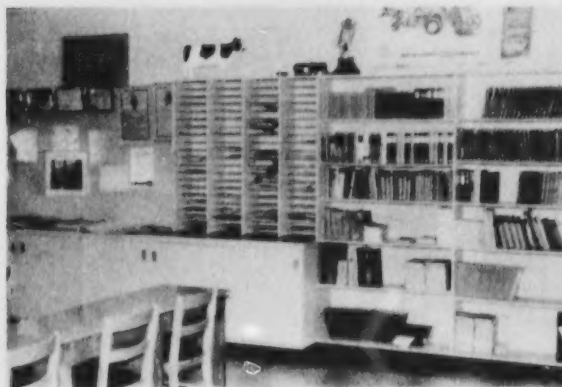
Some minimal spaces versus optimal or recommended spaces are provided in Table II. When space has been shown "per department," it reflects an average enrollment status for a department rather than a maximum expected status.



Flexible student desks, a large chalkboard, and adequate classroom space are essentials. Note the instructor using a construction model in teaching.



An attractive, well planned bulletin board is extremely useful in displaying FFA announcements and coming events and departmental accomplishments.



Adjustable shelving and cabinets in the classroom are essential for storage of books, bulletins, and models used in teaching.



A room divider separates a multiple instruction departmental classroom but allows for expanded use.

TABLE II
SPACE ALLOCATIONS FOR VARIOUS INSTRUCTIONAL
AREAS AND ACTIVITIES

Instructional Area or Activity	Space Per Individual (Sq. Ft.) ^h		
	Minimum	Range	Recommended
Classroom	20 ^a	30-45	45
Office/Conference Room	75 ^f	120-360	120
Laboratories			
General	100 ^b	200-432 ^b	360 ^b
Agricultural Mechanics	50 ^f	100-150 ^e	150 ^e
Horticultural Greenhouse ^c	500 ^c	800-2100 ^c	800 ^c
Land Laboratory	Local Option ^d	Local Option ^d	Local Option ^d
Locker - Washroom, Toilet	100 ^b	100-150 ^b	150 ^b
Outside Work Area			
Total Space	1000 ^g	1000-2000 ^g	2000 ^g
Hard Surfaced Area	750	750-1500	1500

- a. Wisconsin Administrative Code, Section Ind. 56.07. Building and Heating, Ventilation and Air Conditioning Code. December, 1977, No. 264, p. 189.
- b. Per department.
- c. Greenhouse of at least 500 sq. ft. and 300 sq. ft. of floor space in the headhouse for the department.
- d. Dependent of nature, type and availability at the local community level. It may involve a small demonstrational plot or several acres. This might involve animal facilities as well as for crops.
- e. Additional space will be needed for tool room, supply room, paint room, space for equipment, and for general storage space.
- f. Wisconsin Administrative Code, Section Ind. 56.07(b), op. cit., p. 188. The minimum 50 sq. ft. per occupant for the agricultural mechanics laboratory is the amount indicated for an "industrial arts-vocational shop" and is considered inadequate for agriculture; therefore, comparability of functions and space are not necessarily the same.
- g. Per department. Adapted from The Department of Agricultural Education, "Facility Planning and Evaluation Technique for Vocational Agriculture," Iowa State University, Ames, Iowa. 1979. 4 pp.
- h. Per individual unless otherwise indicated in footnote.

The actual space needed in any agricultural/agribusiness department will depend largely on the factors presented in Part I. Space needs for both single- and multiple-instructor departments can be calculated easily by considering: (1) optimum work space per individual, (2) adequate space for storage, (3) work zone area around equipment and machinery, and (4) actual space consumed by essential equipment and machinery.

If, in single-instructor departments, FFA meetings and general meetings are to be held in the agricultural classroom, adequate space for the largest group expecting to use the room should be provided. In multiple-instructor departments, a large multi-use room could be divided into smaller classrooms by using folding doors.

It is generally agreed that classrooms should have at least 45 square feet of space per student, and school agricultural mechanics laboratories should have at least 150 square feet per student. In addition, space should be provided for storage, for equipment and machinery, for office, for laboratory, for locker, for washroom and toilet facilities.

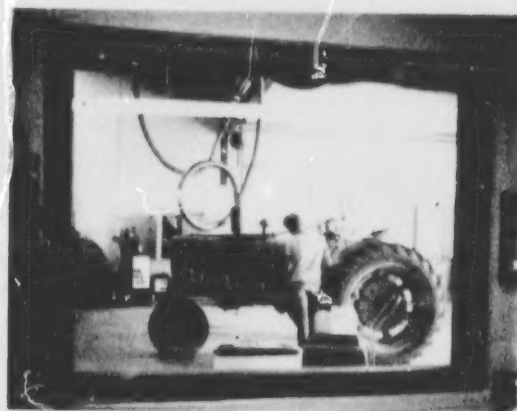
Area in the classroom is devoted generally to four functions:

1. Instruction
2. Student work
3. Teaching materials and reference storage
4. Multi-purpose meetings

With these thoughts in mind, the following formulas have been developed for computing space needs in single-instructor departments of vocational agriculture/agribusiness (with optional space allocations for multiple-instructor departments):



The office-conference room provides many desirable features: communication capability, supervision, desk storage, privacy for student-instructor conferences. In the illustrations, one can observe that through strategic internal window location, the instructor can observe simultaneous learning activities occurring in the general laboratory, the classroom, and the agricultural mechanics laboratory.



1. Classroom¹

- (a) No. student in X 45 sq. ft.²
largest class (no. per student (ave.
student stations) size per student
station) = _____
- (b) 150 to 200 sq. ft. for storage of books,
bulletins, audio-visual aids and materials,
teaching equipment, magazine rack, etc. = _____
- (c) Total sq. ft. needed in classroom
(a + b) = _____

2. Office-Conference Room

- (a) Single-instructor departments:
Space for desk, files, record storage,
counseling students, etc. (minimum
120 sq. ft. desirable) = _____
- (b) Multiple-instructor departments:
Add 60-120 sq. ft. of additional space
per additional instructor = _____

3. Locker-Washroom, Rest Room

Student lockers, industrial-type semicircular wash basin, water closet, urinals. (150 sq. ft. desirable, dependent upon accessibility of such facilities in total building) = _____
(In large units, some code requirements for number of fixtures may be a dictating factor.)

1. William R. Kunsela, "A Comparison of Recommended Sizes in Agricultural Classrooms and Shops for One-Teacher Departments by States in 1953." Non-thesis Study, 1953. Cornell University, 8 P. Agricultural Education Divison, New York State College of Agriculture, Ithaca. (The mean recommended size of classroom was found to be 46.3 square feet per student, based on replies received from 35 state supervisors. The mean recommended size for agricultural shop to accommodate 15 students was 2144.7 square feet of floor space, or 140.7 square feet per student. The mean recommended size of shop to accommodate 20 students was 2466.8 square feet, or 123.4 square feet per student.)
2. Wisconsin Administrative Code, Section Ind. 163.05, Existing Buildings, September 1974, No. 225, p. 30, stipulates the minimum floor space for recitation or classroom shall be 18 square feet per person; however, to provide for an optimal learning environment, 45 square feet of space per student is recommended.

4. Laboratories

(a) General laboratory, e.g., space for milk testing, soil testing, grain testing, moisture determination, seed germination studies, plant growth studies, etc. (360 sq. ft. recommended dependent on scope of local instructional program) = _____

(b) Agricultural mechanics³

(1) Space needed for students

No. students in X 150 sq. ft. min.
largest shop class per student
(student stations) (ave. station) = _____

(2) Space needed for equipment

Equipment and work X No. of items
zone space in (based on data
sq. ft. in Table III) = _____

(3) Demonstration-instructional space in laboratory for small group instruction, with movable chairs and chalkboard
20 sq. ft./student x no. students = _____

(4) Space for storage

If any of the following are to be included, calculate actual sq. ft. of each; below are some ave. areas for storage spaces listed:

Laboratory - general	50 sq. ft.
Tool room	100 sq. ft.
Supply room	140 sq. ft.
Paint room	140 sq. ft.
Land laboratory	* sq. ft.
School forest	* sq. ft.
Others	* sq. ft.

* Square feet dependent on local program needs.

(5) Total sq. ft. area needed for school agricultural mechanics laboratory (a + b + c) = _____

3. Frank J. Blhowiak, "A Study Determining Emphasis Given to Farm Shop and Training Methods in Farm Mechanics for Teachers of Vocational Agriculture". M.S. Problem, Department of Agricultural and Extension Education, University of Wisconsin, 1955. pp. 36-37. Six of ten North Central States reporting (by Teacher Trainers) state shops should be 40' by 60' minimum, two states indicated 36' by 60' minimum; two indicated that 150-200 sq. ft. per student should be provided.

- (c) Greenhouse - horticultural demonstrational and production center, involving a headhouse and greenhouse facility
- (1) Headhouse (dependent on program emphasis, it is recommended that 300 sq. ft. be provided = _____
- (2) Greenhouse (dependent on program emphasis, it is recommended that 500 sq. ft. min. be provided per single-instructor department with 65 sq. ft. area per student recommended) = _____
- (d) Land Laboratory, e.g., land and appropriate storage facilities for equipment and machinery which might be used for a school farm, a school forest, nature study of wetlands, occupational learning, demonstrational teaching, and animal facilities, if appropriate. Calculate space for building needs and land acreage based on local educational needs, costs, and availability = _____
- (1) Storage facilities at the site (____ sq. ft.) = _____
- (2) Acreage = _____
- (e) Simulation laboratory for agribusiness occupations and experiences. Dependent on local educational needs ____ sq. ft..... = _____
5. Total area (square feet) needed in single-teacher vocational agriculture/agribusiness department, add:
- 1c + 2 + 3 + 4(a) - (e) = _____

Totaling these figures, generally results in classrooms of 800-1000 square feet, and laboratories of 2400-3600 square feet for single-instructor departments. Multiple-instructor departments would probably have two classrooms of 700-900 square feet each, and an agricultural mechanics laboratory of at least 3300-3600 square feet. If shared-space concept is operative, space allocations might be altered accordingly. Additional information on arrangement, layout, and space organization will be presented in the remaining parts of this publication.

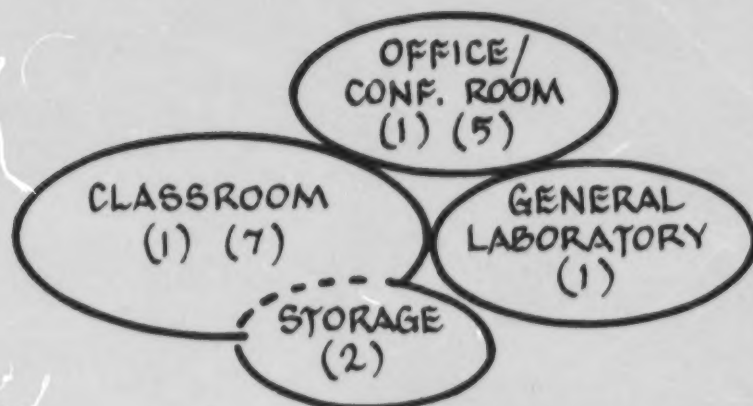
Data in Table III are provided as an example for computing space needs for equipment and the work area in the agricultural mechanics laboratory. Equipment listed is not necessarily recommended for Wisconsin. A suggested minimum equipment list for departmental facilities can be obtained from the Wisconsin Department of Public Instruction.

General Departmental Plan A well-planned vocational agriculture/agribusiness department should be:

1. Planned as a unit
2. Located on ground level
3. Attached to or located close to the central school building
4. Located to control noises, particularly those from the agricultural mechanics laboratory
5. Internally arranged to allow for good instructor supervision
6. Organized to minimize cross-traffic patterns through various instructional areas

The illustration which follows provides a conceptual space relationship to functional use, interrelated to several important factors, such as student supervision.

CONCEPTUAL SPACE RELATIONSHIP TO FUNCTIONAL USE



FACTORS TO CONSIDER:

- 1) STUDENT SUPERVISION
- 2) CONVENIENCE
- 3) MATERIAL HANDLING
- 4) SAFETY
- 5) COMMUNICATION
- 6) COST
- 7) MULTI-USE

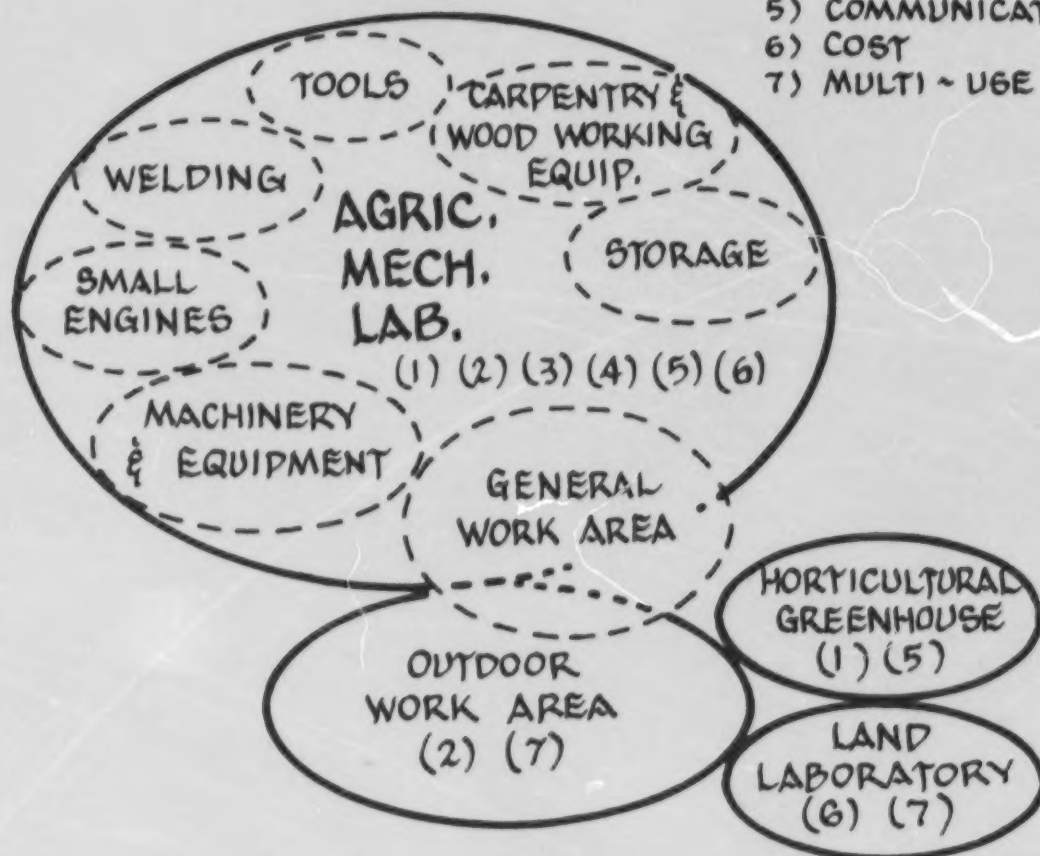


TABLE III

DETERMINATION OF EQUIPMENT AND WORK SPACE NEEDS
FOR SCHOOL AGRICULTURAL MECHANICS LABORATORY*

Equipment Item	Equip. Space sq. ft.	Equip. Space + Work Space sq. ft.	No. of this item	Total Space Needed sq. ft.
Air Compressor	10	20	--	---
Chalkboard, Portable	5	15	--	---
Drill, Post	3	35	--	---
Drill, Press	2	35	--	---
Grinder	2	30	--	---
Jointer	8	90	--	---
Lathe, Metal	5	35	--	---
Lathe, Wood	5	35	--	---
Lumber Rack	24	65	--	---
Metal Rack	10	35	--	---
Planer, Thickness	6	135	--	---
Sander, Belt	4	35	--	---
Sander, Disc	3	45	--	---
Saw, Band	6	80	--	---
Saw, Hack	4	60	--	---
Saw, Radial Arm	40	125	--	---
Saw, Scroll	6	75	--	---
Saw, Tilting Arbor	12	200	--	---
Sheet Metal Brake	8	48	--	---
Sheet Metal Roller	4	25	--	---
Table Welding	6	35	--	---
Table, Woodworking	20	40	--	---
Welder, Arc	4	20	--	---
Welder, Gas	3	20	--	---
TOTAL				=====

* Adapted from:

- a. Bear, W. Forrest, Hoerner, Thomas A. Planning, Organizing, and Teaching Agricultural Mechanics. Hobar Publications, 1305 Tiller Lane, St. Paul, Minnesota 55112. p. 96.
- b. Stallsmith, Douglas D. Guidelines For Planning Industrial Education Facilities and Equipment. Bulletin #9167 Wisconsin Department of Public Instruction, 126 Langdon St., Madison, WI. pp. 8-13.
- c. Department of Agricultural Education, "Providing Facilities for Departments of Vocational Agriculture in Georgia, Vocational Education in Agriculture," Professional Series Bulletin, No. 2. April, 1954. p. 57. University of Georgia, Athens, Georgia.

Heating An adequate heating system with consideration of fire protection is needed for the agricultural/agribusiness department. Heating systems in departments in Wisconsin include:

1. Steam or hot water systems using radiators, convectors, unit ventilators or unit heaters.
2. Forced or gravity warm air systems. (Gravity warm air systems will not help with ventilation.)

In any case, all heating plants in one-story buildings shall be enclosed with not less than two-hour fire-resistive construction.⁴ If the department is included as a part of the general school building, the heating is a total heating consideration and not just one of the department. If a central heating plant is used, give attention to heating the agricultural department for use at night. Proper controls should be provided to conserve as much energy as possible.

Lighting--Artificial and Natural There are several factors which affect the adequacy of lighting in a school building:

1. Extent of natural lighting through windows or vision areas.
2. Distribution and diffusion of all light sources.
3. Location and number of artificial lighting features.
4. Supplementary light at the point of work and other strategic points.
5. Function performed or purpose to which room or space is devoted.
6. Painting and finish of permanent structures and equipment to meet varying degrees of light reflection.
7. Adequacy of circuits to conserve energy.

Some basic objectives of the total lighting system, both natural and artificial, should be to:

1. Avoid glare (direct or reflected) or excessive brightness.
2. Reduce possibilities of eye fatigue, discomfort and annoyance.
3. Provide optimum lighting with good distribution and diffusion.
4. Provide supplementary lighting for limited areas at or near eye-level.
5. Uniform distribution of illumination.
6. Illumination intensities adjusted to very difficult seeing tasks to lesser difficult seeing tasks and activities. In considering natural light, balances between energy conservation (i.e., heat gain in summer and heat loss in winter) should be studied.

4. Wisconsin Administrative Code, Section Ind. 160.01, No. 225, Op. cit. p. 31.

Artificial lighting will generally be the enclosed type located overhead. Having separate switches for lights near windows and those farther from windows is more efficient and helps equalize and supplement natural lighting. Good lighting pays off in less eye strain, better student morale, better housekeeping and better study and work conditions.

Locate control panels for the convenience of the agricultural instructor. Electrical switch boxes should be color-coded. DuPont Color code specifies blue for switch boxes, whereas Pittsburgh Color Dynamics code specifies floral orange. Consistency throughout should be followed. This is especially important in controlling electricity in the agricultural mechanics laboratory. Lighting for exits, stairs and corridors and emergency lighting should be independent of classroom and laboratory lighting. Locate switches so persons can light their way from one point to the next. There should be adequate shielding for lights as well as provisions for careful adjustments.

Artificial lighting is necessary in all instructional areas. Approximately 60 percent of the winter daylight hours in Wisconsin are hours of sunlight. For this reason, sufficient electric illumination must be provided to meet the artificial illumination code requirements. Minimum permissible illumination for various department areas is given in Table IV. Systems, recommended today, are dual switching so that alternate fixtures may be switched off for energy conservation.

Natural lighting should be provided through windows or vision areas placed to achieve a balance between wall usage and light distribution. If skylights are used, make provisions for brightness control. Prevent direct sunlight or bright rays going directly to work and study areas. Natural illumination is typically provided by:

1. Unilateral system - daylight illumination from one side only of a school room (desirable from the left side of students).
2. Bilateral system - daylight illumination from two sides of a school room (desirable from the left and rear of students).

Lighting consultants should be utilized to determine the type and number of light fixtures for various instructional spaces dependent on the use of fluorescent versus incandescent fixtures. Stallsmith⁵ provides recommended minimum levels of general illumination as provided by the Illuminating Engineering Society for industrial education areas which are considerably greater than the minimum allowable by Wisconsin's lighting code, e.g., classroom area - 150 footcandles, office area - 150 footcandles, and material storage - 30 footcandles.

Additional information on window size and placement is presented in discussion of the classroom and agricultural mechanics laboratory.

-
5. Douglas D. Stallsmith, Guidelines for Planning Industrial Education Facilities and Equipment. Bulletin No. 9167. Wisconsin Department of Public Instruction. 1977. p. 79.

TABLE IV

INTENSITY OF ARTIFICIAL ILLUMINATION AT THE POINT
OF WORK IN SCHOOL BUILDINGS, 1970⁶

Room or Space Illuminated	Minimum Maintained Illumination at Point of Work in Footcandles*
Classroom - - - - -	50
Conference and file rooms- - - - -	20***
Office - - - - -	30***
Laboratory (testing room) - - - - -	75
Drafting room - - - - -	75
Locker room - - - - -	10
Passageways - - - - -	5
Corridors containing lockers and stairways - - - - -	10
Washrooms - - - - -	10
Storage and other casual seeing areas - - - - -	5
Shop-vocational training	
Bench and machine areas - - - - -	75
General areas - - - - -	75
Exit signs and emergency lighting - - - - -	**

* Illumination at the point of work (work plane) is generally considered to be 30" above the floor.

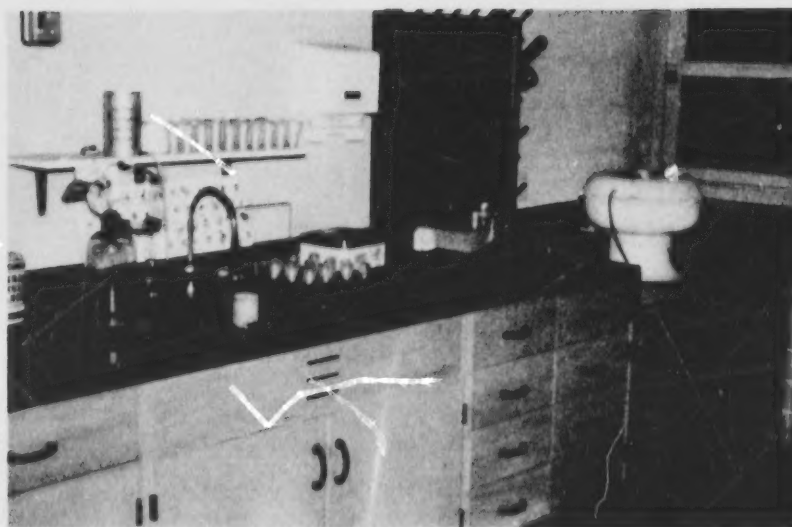
** See Part G, Emergency Lighting, Wisconsin Administration Code, 19.18-19.22 for details.

*** Often conference rooms and offices must serve for long meetings. An increased illumination up to 45-50 footcandles would be quite desirable.

6. Wisconsin Administrative Code, Section Ind. 19.01-19.22. Illumination Code, October, 1970, No. 178. pp. 3-8.



Scientific testing and analysis in agriculture should be instilled into the learning pattern of students. A general laboratory with adequate sinks, cabinets, lighting, and work areas is highly essential.



A well-equipped, well arranged laboratory can be used for milk testing, soil testing experiments, testing moisture of grains, and similar procedures for several subject areas.

Painting Permanent Structures Color, properly used, can add interest to the school surroundings and increase the students' sense of satisfaction. Color can control the reflection of light, reduce fatigue, improve appearance, and promote safety. Your registered architect can be helpful in working out the most effective color schemes. Planning a color scheme for an agricultural education facility is important as it should provide a good learning environment as well as an aesthetic appearance.

Ceilings of instructional spaces should be finished in a color having an initial coefficient of reflection of at least 0.75. New white paints meet this standard.

Walls of instructional areas from the ceiling down to the top of chalk boards or to a height of 2' 8" above the floor where there are no chalk boards, should be finished by colors having an initial reflection factor between 0.45 to 0.60. Wall space below 2' 8" generally may have a darker finish. The following colors have a coefficient of reflection in the vicinity of 0.45 to 0.60.

<u>Color</u>	<u>Coefficient of Reflection</u>
Buff - - - - -	0.44 to 0.59
Gray - - - - -	0.15 to 0.67
Light Green - - - - -	0.43 to 0.67
Light Blue - - - - -	0.31 to 0.57
Pink - - - - -	0.32 to 0.70
Yellow - - - - -	0.55 to 0.70

The following colors have a coefficient of reflection generally below 0.45, and can therefore be used on the lower parts of walls:

<u>Color</u>	<u>Coefficient of Reflection</u>
Dark Green - - - - -	0.10 to 0.22
Dark Tan - - - - -	0.27 to 0.41
Natural Wood Brown Stain - - - -	0.15 to 0.26
Light Wood Varnish - - - - -	0.36 to 0.44
Gray - - - - -	0.15 to 0.67

Colors having a wide range of shades make possible many pastel color combinations for the agricultural facilities. The ceiling should be finished in white, and the upper walls in light color shades. The lower parts of the walls can be finished in darker shades. Wood trim can be finished in darker shades and in natural wood finish, giving a dull surface. Darker colors on lower walls tend to remain neater. (Footmarks, etc. are often masked.)

Color combinations should be studied and applied to limited areas before a final selection is made.

Some useful references in studying colors for agricultural facilities include:

1. Douglas D. Stallsmith, Guidelines for Planning Industrial Education Facilities and Equipment. Wisconsin Department of Public Instruction, Bulletin No. 9167, pp. 16-17.
2. Pittsburgh Color Dynamics, Scientific Utilization of the Energy in Color to Promote Efficiency in Industry. PPG Industries, Inc., Pittsburgh, Pennsylvania.
3. Harry F. Ulrey, Building Construction and Design, Howard W. Sama and Co., 4300 W. 62nd Street, Indianapolis, Indiana, 1970.

The following color schemes for a classroom have been suggested:

Ceiling -- Egg shell white -- Light bone white

Focal wall -- Eye rest green -- Aqua

Other walls -- a lighter shade of green -- a lighter shade of aqua

Dado -- Eye rest green -- Turquoise

Trim and door facings -- Vista Green -- Light ocean green

Ventilation Fresh outside air is needed for normal ventilation of classrooms and to remove dust, smoke and fumes in the shop, laboratories, and other occupied areas. (See Table V.) Regulations governing classrooms and for other occupancies are covered in the heating, ventilation and air conditioning codes, and those regulating shop ventilation are included in the "Dusts, Fumes, Vapors and Gases Code" of the Department of Industry, Labor and Human Relations, State of Wisconsin. A separate mechanical exhaust system should be provided in the agricultural mechanics laboratory to remove fumes from welding operations.

Air change (fresh air introduction) at the rate of six air changes per hour is required for classrooms and for all occupancies unless otherwise specified by code.^{7, 8} This often is largely taken care of through doors and windows, although mechanical ventilation systems are becoming more common and do the job in a draft-free and positive way.

7. Wisconsin Administrative Code, Section Ind. 64.06-64.18. No. 276, op. cit. p. 260.

8. Ibid., pp. 253-254.

TABLE V
VENTILATION REQUIREMENTS FOR DIFFERENT OCCUPANCY AREAS⁹

Use of Occupancy	Ventilation Classification	Minimum Inside Temp. (Deg F)	Applicable Occupancy Code (Ind No)
Admin. Office space	(b)	67	64.56
Conference room	(b)	67	64.56
Laboratories (science)	(a)	67	64.18
Toilet rooms	(d)	65	64.56
Vocational Shops			
With vehicle service and repair	(c) or (d)	60	64.18
Without vehicle service and repair	(a)	60	64.18

- (a) Requires a supply of outside air and an equal amount of exhaust ventilation be provided at the rate of CFM per person.
- (b) Requires a supply of outside air and an equal amount of exhaust ventilation at the rate of 5 CFM per person, or a percentage of openings.
- (c) Requires a supply of outside air and exhaust determined on the basis of CFM per square foot of floor area.
- (d) Requires exhaust ventilation determined on the basis of CFM per square foot of floor area. The area should be provided with negative pressure relative to adjacent areas. A supply of outside air is required when the total building exhaust exceeds one air change per hour, unless otherwise exempted. In multiple-use occupancies, the area of each occupancy should be considered separately.

9. Wisconsin Administration Code, Section Ind. 64.07, No. 264, op. cit. pp. 227-238.

The need for forced ventilation depends upon:

1. Functions performed in the department, especially the agricultural mechanics laboratory and for other laboratories.
2. Number of pieces of equipment which require ventilation and extent of use.
3. Number of individuals in a given area.
4. Amount of natural ventilation provided by windows and doors.
5. Type and amount of contaminated air which needs removing. Air may be contaminated by odors, fumes, noxious gases, smoke, steam, dust or spray. OSHA regulations should be consulted.

In an agricultural mechanics laboratory, where motor-driven vehicles are to be repaired, a mechanical exhaust system must be provided to remove exhaust fumes from internal combustion engines.

Since air contamination involves health and safety of individuals, it is imperative that the architect and building contractors be fully aware of the intended uses of multi-use classrooms, general laboratories, and particularly, the agricultural mechanics laboratory, to make sure that proper air exchange is provided naturally and by mechanical ventilation. The agriculture/agribusiness instructor should fully acquaint the architect and building contractor with the uses to which different building areas will be put to assure plans for appropriate ventilation.

Noise Control Students and instructors should never be exposed to prolonged periods of noises. Placement and use of equipment and machinery which tend to produce occupational noises in the agricultural mechanics laboratory should be analyzed carefully to reduce noise level to the extent possible. Hearing loss can occur if one is exposed to high intensity sounds over a period of time. The period of time which one can experience without hearing loss is related to the sound level expressed in decibels. A sound level of 90 decibels for eight hours is a basic standard. A person should never be exposed to sound levels above 115 decibels.¹⁰ An architect should be in a position to help design a facility with a layout to reduce the incidence of noise problems. Accoustical treatment plans are highly desirable. OSHA standards have been established and they should be consulted.

10. Stallsmith, op. cit., p. 64.

The Agricultural/Agribusiness Classroom

The classroom is the primary teaching/learning center of vocational agricultural/agribusiness education. This center must be planned so that it will contribute most effectively to sound agricultural education and so that it will serve as a multiple-use instructional area. Since the classroom is the focal point in planning, other departmental areas should integrate with it to make a functional unit. For multi-instructor departments, additional attention needs to be given to planning for adjoining areas which, upon need, can be made into a larger area for departmental-wide meeting uses.

Size and Shape Plan at least 45 square feet of floor space per student based on the largest expected class. Also, 150 to 200 square feet of floor area is needed for storage of books, bulletins, charts, other teaching aids and supplies.

The room should be rectangular in shape to: (1) allow for visual aids projection, (2) permit better viewing by students of front instruction area, and (3) provide a more optimum arrangement of classroom facilities. The classroom length should not exceed, generally, the width by a ratio of approximately 1-1/2 to 1. The actual dimensions will, however, be influenced by the internal location of storage units, cabinets, and other supply facilities.

Ceiling The ceiling height of the agricultural classroom should be approximately 12 feet; however, a minimum of 10 feet is currently permissible. The ceiling should be acoustically treated to reduce noise as well as comply with fire resistive code. Caution should be exercised that materials selected do not contribute to health hazards. The ceiling should be painted in some shade of white to provide for maximum light reflection. Finish of walls and ceilings should comply with standards presented under "Painting Permanent Structures", see page 56.

Windows Windows, if in the agricultural classroom, should be grouped to allow most efficient use of available wall space and to conserve energy. One-story buildings with no floors below are not required to have exterior wall openings other than required exits.¹¹

Windows should never be located in the front wall (wall facing students when in their seats) of a classroom. Chalkboards should not be located in a wall with windows nor within six feet of any window. The architect should provide insight and information about windows and their relationship to need for artificial lighting, adequate ventilation and energy conservation.

11. Wisconsin Administrative Code, Sec. Ind. 56.05, No. 276, loc. cit. p. 188.

Doors Entrance into the classroom depends upon corridors, the internal organization of the agricultural department and the department's location in relation to the other school facilities. With classrooms serving more than 51 persons, the door should swing outward toward the means of egress.¹² A main entrance door (3'4" x 6'8" to 7') can be located near the front of the instruction area or at the rear of the classroom, depending upon room arrangement. Special care should be taken to provide exterior doors equipped with panic bars for opening ease for individuals in wheel-chairs.

Each of these locations has its advantages and disadvantages. Doors located at the front and to the side of the instructional area make the instructor somewhat more accessible to callers, yet entrances at the rear and to the side keep student traffic out of the general instructional area. Arrangement of laboratory and office facilities will determine location of doors into the agricultural mechanics laboratory and other areas. Door placement can aid in sound control. Office and laboratory rooms between the agricultural mechanics laboratory and classroom act as sound barriers. Classrooms serving 51 persons or more must have at least two exits.¹³

Window Shades Any classroom exposed to direct or reflected sunlight should be provided with some type of effective roller shades, blinds, or drapes for blackout purposes.¹⁴ The classroom used for projection, should have opaque shades to darken the room. Whenever a classroom is used for projection, good ventilation becomes an absolute necessity. An effective means of daylight brightness control is a must.

Chalk Board and Bulletin Board Chalk boards should not be located on the same wall with windows nor within six feet of any windows. Light green chalk boards are preferred over the former "blackboard". Eighteen to 22 linear feet of chalk board are recommended. A chalk board four feet in height, with its base two feet-six inches above the floor, is very common and satisfactory.

Vertical and horizontal panel type-moveable chalk boards are being used some. They meet a variety of teaching situations.

Provisions can be made above the chalk boards to attach charts, graphs, and other teaching materials. Sliding clips generally have proven satisfactory for this purpose.

12. Ibid., p. 192

13. Wisconsin Administrative Code, Section Ind. 56.06, No. 276, loc. cit. p. 190.

14. Wisconsin Administrative Code, Sec. Ind. 19.13, No. 178, loc. cit., p.6.

Bulletin boards (cork or other suitable materials) are useful in the agricultural department for:

1. Displaying teaching materials
2. Agricultural items "for sale"
3. "Desire to purchase" items
4. Students' supervised occupational experience program
5. F.F.A. activities

Small bulletin boards can be effectively placed at the ends of the chalk board. Frequently, bulletin boards can be placed on a side wall or at the back of the classroom and in the general laboratory and the agricultural mechanics laboratory. Bulletin boards above wall cabinets can be used effectively. A minimum of 16 linear feet is recommended.

Storage for Large Charts and Posters Charts and posters approximately 22 by 28 inches can be stored effectively in specially constructed cabinets, either in a vertical or horizontal position. Shallow shelving in either case is highly desirable. A large drawer on roller bearings with vertical storage is quite satisfactory. An index of all charts, posters, maps, etc. should be posted close to the storage area to speed location of items.

Display Case Display of teaching specimens, of trophies won by the F.F.A. chapter members, and of exhibit type items for incidental learning is frequently desirable. A modest sized display case (glassed) measuring 2' x 4' high x 6-8' long would be very helpful in the instructional program.

Computer Capability Services and Space With programmed services increasingly being available for making farm management decisions, for analyzing agricultural businesses, and for acquainting youth and adults about these technical services, the classroom should be equipped for appropriate telephone services and for appropriate storage for security purposes. It is advisable that either a separate small office or an enlarged office-conference room be provided to store a programmable micro computer, remote terminal, printer, and telephone. Since the micro computer is the costly item, it should be located in the office in a locked cabinet. Presently certain micro computers can be connected with up to seven terminals for student use. These terminals, which individually need about 2' x 3' of total space, can be located in either the office-conference room, the general laboratory, or the classroom. Use of computers in ration balancing, in farm management decision-making, such as break-even purchase price per 40 pound feeder pig to 220 pounds, etc. in the future should be considered as analogous to laboratory milk testing or soil testing or seed germination testing.

Several recent technological innovations in the computer industry have greatly enhanced the potential for computer applications in agricultural education. The most exciting of these is the low cost, high speed micro computer. These machines currently range in price from less than \$1,000 on up to \$10,000, depending on the amount of memory, the type of output devices, and other options the end user may need. These new micro computers typically use a programming language called BASIC, which is very easy to use.

The primary benefit of computer-aided instruction is that it allows the instructor to cut through the mathematics of a problem and concentrate on its conceptual aspects. It allows the students to ask "what if" questions while their interest is at a peak. It also has great potential for programmed learning.

Unlike the programmable calculator, the micro computer and timeshare computer can be programmed to lead a beginning student through most problems even without prior experience.

The biggest limitation presently is the availability of good user oriented agricultural software. (Software is the instruction set which tells the computer what to do.) This problem will improve with time. Micro computer program listings will become much more available in the near future. Keep in touch with your agricultural college specialists for further developments.

Book and Bulletin Storage Books and bulletins can be stored satisfactorily at the sides or at the back of the classroom.¹⁵ Adjustable shelving will accommodate a variety of book sizes and bulletin boxes. Frequently, it is desirable to supplement this storage with wall cabinets which have drawers and adjustable shelving. Some drawers for storage of corn and grain should be metal-lined to guard against insect and rodent damage.

Floors (Classroom) Hardwood floors properly treated are satisfactory for the classroom. Concrete floors are not desirable unless covered with a recommended material which is attractive and easy to maintain. Not all tile is recommended over concrete, so check this carefully. Resilient floor tiles with asbestos fibers should be avoided.

15. For a list of recommended agricultural publications, write to your State Department of Public Instruction.

R

Furniture Each agricultural/agribusiness classroom should have an instructor's demonstrational desk placed at the front of the room. A lectern should be accessible at all times for the instructor, as needed.

Desks or tables 28" x 60" which accommodate two students at one side have proven satisfactory. The number of such tables or desks depends upon the number of students expected in the largest class. Such tables can be placed in a "U" shape for class discussion, in rows, or otherwise across the classroom. In any case, wall aisles not less than three feet in width should be provided.

Magazine racks with slanted shelving are desirable for the classroom. Shelves in the lower part of such racks can be used for previous copies of agricultural/agribusiness periodicals. Similarly, student notebook racks designed for three-ring notebooks to accommodate the total student enrollment should be located near the entrance door of the classroom or some other convenient area so that students can obtain them as they enter the room. These notebooks should be numbered to match the rack openings.

A four- or five-drawer steel file for storing F.F.A. materials and other general information used by students should be located in the classroom.

There should be a sufficient number of solid construction type chairs to accommodate the maximum number of individuals which might use the classroom. Folding chairs might be used in some instances to provide seating flexibility.

Electrical Outlets It is often difficult to plan in detail the location of convenience outlets. A good rule is to have outlets no more than 10' or 12' apart, so for any use you are never more than 6' from an outlet in any position along a wall. Plan so that extension cords never run across a doorway. Projection equipment is commonly used in an agricultural/agribusiness classroom, so provide the necessary outlets at the point the projector is placed. A "built-in" extension cord for the speaker will avoid running a cord from the speaker to the projector on the floor surface--a hazard to those entering or leaving when a film is being shown.

A ground fault interrupter system should be a part of the electrical installation throughout the entire department. Such a circuit interrupter provides protection from electrical shock when persons are working in wet and hazardous environments.¹⁶

16. Farm Department, National Safety Council, Power Tools, Bulletin A-001-79, 444 North Michigan Ave., Chicago, Illinois 60611. p. 1.

Suggested Minimum Equipment Room equipment recommended for the agricultural/agribusiness classroom includes:

1. Bookcases or shelves - - - - - 150-200 linear feet of adjustable shelving for books, bulletin boxes, etc.
2. Bulletin board - - - - - 16 linear feet
3. Cabinets - - - - - 20 linear feet, 24" deep; at least one large drawer (18-24" deep) for chart and poster storage
4. Metal-lined storage space- - - - - Built into cabinets or wall; mouse and mothproof storage for samples of grain, etc.
5. Chalk board - - - - - 18 to 22 linear feet
6. Magazine rack - - - - - Slanted shelf type, with shelves in lower part
7. Student desks or tables - - - - - 28" x 60" tables accommodating two students each for maximum number of users at one time
8. Student notebook rack- - - - - One position for each student
9. Steel file cabinets - - - - - Four- or five-drawer with lock for FFA materials
10. Projection screen and speaker - - - - - Retractable wall mounted permanently at front if audio-visual instruction provided in classroom
11. Opaque shades for windows - - - - - If classroom is used for projection
12. Instructor's desk - - - - - Demonstrational type
13. Instructor's lectern - - - - - Portable

A suggested minimum equipment list for agricultural departments, including items for the classroom, office-conference room, laboratory, and the agricultural mechanics laboratory is generally available from the state consultant or supervisor's office.

Office-Conference Room

The office-conference room serves as the basic space wherein the instructor plans, organizes and prepares the agricultural instructional program. It must necessarily be semi-private to provide opportunity to counsel students on a confidential basis. The office-conference room should have a minimum of 120 square feet of floor area in a single-instructor department. Multiple-instructor departments might have separate or joint offices for two or more instructors, with a minimum of 200 square feet of floor area desirable. If the instructors are to be officed together, 120 square feet should be allowed, plus at least 60 square feet for each additional instructor.

Sufficient window area should be provided in the office-conference room for observation and supervision of students in the laboratory, classroom and agricultural mechanics laboratory.

Lighting, ventilation and painting of the office should be similar to the classroom.

Equipment and facilities which should be provided include:

1. Instructor's desk
2. Four- or five-drawer expandable steel file
3. A small conference table with several chairs for students and small group meetings
4. Cabinet and shelf storage for teaching materials, slides, films, etc.
5. Storage for delicate and expensive laboratory instruments
6. Storage for professional reference material
7. Place for typewriter, calculators, computer terminals, micro computer, and duplicating equipment necessary for correspondence, record keeping, and classroom and laboratory preparations
8. Telephone service to the agricultural office
9. A small closet for the instructor's laboratory coats, coveralls, boots, hat and other items
10. Intercommunications system to the central school office would be desirable
11. Book shelves for the instructor's professional reference
12. Locked storage cabinets for securing computer equipment and programs (see section on "Computer Capability Services and Space").

Locker and Toilet Facilities

The need for toilet facilities will depend upon accessibility of existing ones in the main school building. If not convenient to the agricultural/agribusiness department, additional ones should be provided with facilities which will accommodate handicapped individuals. Adequate lighting, ventilation and heating are necessary. Cleanliness is extremely important. Sufficient space should be provided for urinals and water closets.

Lockers for students conveniently located adjacent to or in the proximity of the agricultural mechanics laboratory are highly desirable. Students could store their shop aprons, coveralls, coats and other personal items which are needed in all laboratory work.

General Storage Room

The need for a general storage room depends upon the extent to which other storage is available. A storeroom of approximately 140-150 square feet, located adjacent to the classroom and agricultural mechanics laboratory could be used effectively for storing photographs and projection equipment, large maps, models used in teaching, other visual teaching aids and materials, portable electric equipment for the agricultural mechanics laboratory, etc. Some of the equipment listed in the section "Department Laboratories" might be stored in this room.

If a small storeroom is to contain primarily teaching materials and general classroom supplies, it should be located as near to the classroom as possible. In either case, adequate open shelving provides flexible storage. The arrangement within and other storage features of the room largely depend upon its intended use.

Department Laboratories

The concept of "Doing to Learn" is the cornerstone of vocational education. Agricultural educators throughout their long history have focused their instruction on this learning methodology. Earlier the vast majority of vocational agriculture students came from farms, and thus had many opportunities on the home farm for "hands on" activities. However, since the passage of Vocational Education Act of 1963, the program of vocational agriculture/agribusiness has expanded into the agribusiness field, including agricultural supplies and services, agricultural products, ornamental horticulture, agricultural resources including conservation utilization and services, forestry and other agricultural occupations.

The expanding opportunities in American agriculture have resulted in curricular changes in many departments, and consequently, many students from an urban setting and females are enrolling to receive training for occupations in this vital industry. This change in emphasis and a more diverse student population necessitates careful planning and study for laboratories when new facilities or remodeling is contemplated. Since present and future curricular offerings are the ultimate concern in determining facilities, including laboratories, it is vital that the advisory committee, teachers, administrators, students and F.F.A. alumni members conduct a needs assessment and follow with a carefully designed plan of action. (See Part I.) Many departments in the past included a classroom, farm shop, a milk testing room and limited amount of storage space. Today, because of the broader program emphasis and a more diverse student population, one is likely to find more land laboratories, i.e., corn and grain test plots, herbicide test plots, gardens, growth chambers, greenhouses, and school forests. Consider, also, providing facilities for computer terminals to be used in the instructional program. Local instructors may also work out arrangements with area farmers for the use of their farm for the study of soil, conservation practices, woodlot management, field arrangement, cropping practices, etc. Similar arrangements may be made with local agribusinesses for the study of farm equipment, and other specific experiences which enhance the learning opportunities for all students.

General Agriculture/Agribusiness Laboratory

Recognizing the changing needs, a general agriculture/agribusiness laboratory of 100 to 400 square feet of floor space is recommended for students in the community to be used for:

1. Testing milk
2. Testing soils
3. Conducting seed germination tests
4. Testing moisture of grains
5. Grading grains
6. Storing refrigerated items
7. Making postmortems of small farm animals and poultry
8. Performing other functions under supervision of the local agricultural instructor.

The actual size of the area would depend upon the scope and nature of the laboratory program of the department.

Extensive storage space in the form of cabinets surrounding the room is needed. A work table is needed for computing and recording data in the various testing programs.

Provisions for (1) gas or electricity for heating of laboratory materials, (2) ventilation, and (3) hot and cold water should be provided at the time of construction. An acid-proof sink and plumbing should also be installed. Several instructors have found that stainless steel cabinet tops and sinks are resistant to chemicals commonly used in the laboratory and are easy to clean.

Convenience outlets should be located where they are likely to be used, and must be provided for a refrigerator. Good lighting is a must for efficient laboratory study.

A floor drain is needed so that the room can be easily washed and cleaned.

If an extensive testing program is planned, the equipment for each phase should be organized into separate units. Label the areas and storage cabinets to coincide with the functions performed. This will help organize the room more efficiently and avoid confusion.

A bulletin board should be located in the laboratory, displaying procedures for laboratory testing, regulations, and other information.

The instructor should be able to observe students working in the laboratory from both the classroom and the agricultural mechanics laboratory.

Equipment needed for laboratory work and teaching purposes in agriculture/agribusiness includes:¹⁷

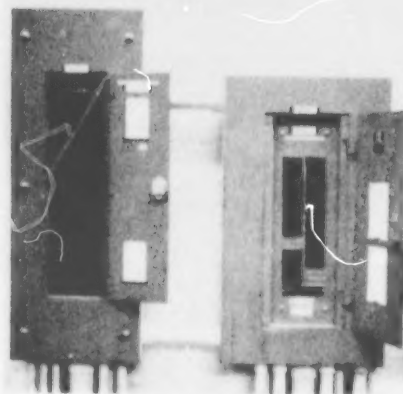
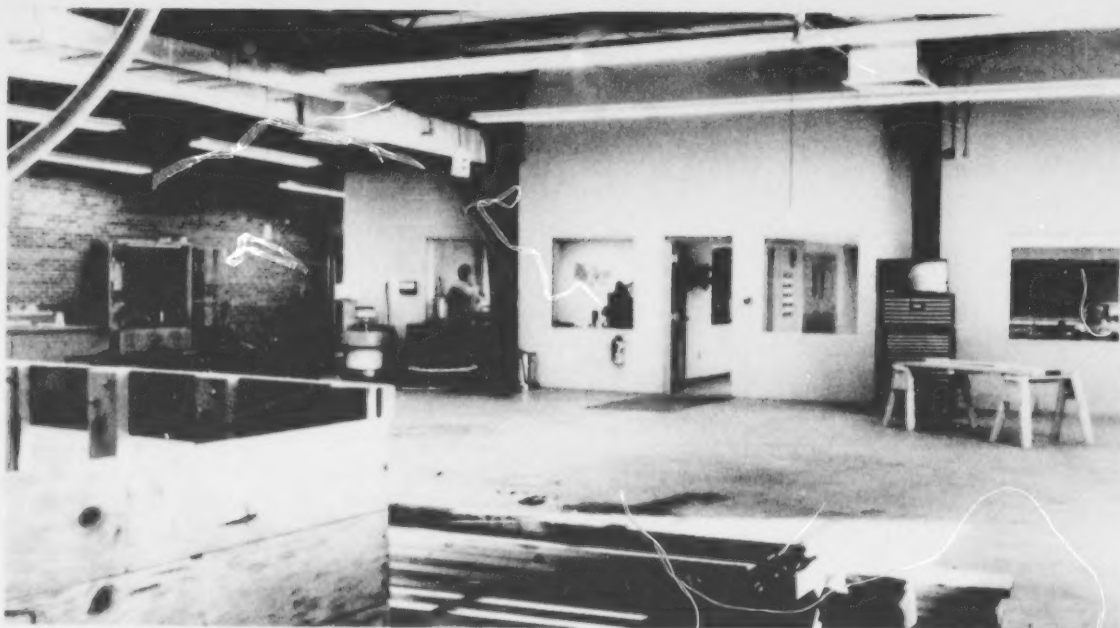
1. General laboratory and classroom equipment

(Beakers, bulletin boxes, evaporating dish, flasks, glass tubing, forceps, graduate cylinders, litmus paper, mortar and pestle, platform balance, laboratory and cream scale, ring stand, rubber tubing and stoppers, test tubes and brushes, thistle tube, wire gauge, microscope with slides and covers, microscope, movie projector, overhead projector, slide projector and screen, camera (Polaroid and 35 mm F 1.8 for slide making).

17. Check with your State Department of Public Instruction and University Teacher Education in agriculture department for up-to-date suggested equipment lists for an agriculture/agribusiness department.

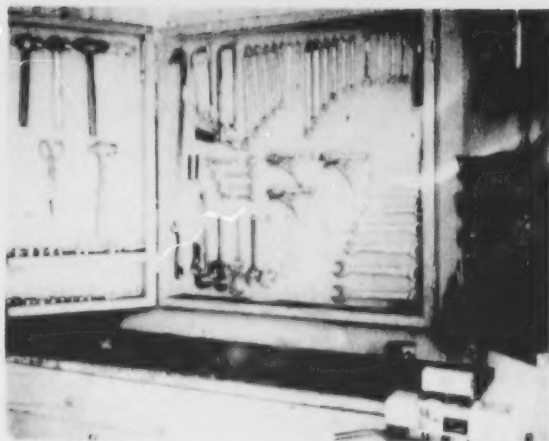
2. Crop and horticultural instructional material and equipment
(Tripod magnifiers, weight-per-bushel scale, seed dockage sieves, moisture tester, combination long-handled pruner, lopping shear, pruning saw and shears, seed germinator; samples of common grain and forage crops, forage sampler, grafting materials and tools, weed seed samples and mounts, pressed weed samples, shelled samples of Wisconsin hybrid strains, hybrid corn grade samples, crop samples showing diseases and nutritional deficiencies, samples of insecticides and fungicides, and mounted specimens of insects and insect damage; power and hand sprayer, pots, peat and potting material, automatic watering unit, misting unit, flats, watering cans, florist shears, garden rakes, hoes, shearing knives, spades, spading fork, propagating mats, lighting unit, level and tripods, etc.)
3. Soils instructional material and equipment
(Soil and plant tissue tester, samples of essential plant food elements, soil samples and auger, grinder, set for soil capillarity demonstration, soil profiles, monolith, soil thermometer, percolation of water tube, water holding capacity tube, soil type samples, tree planting bars, and parent rock samples.)
4. Poultry instructional material and equipment
(Egg scale, candling box, caponizing tools, live bird scale, poultry shipping crate, single bird exhibition coops, posting tools, and preserved parasite and disease specimens.)
5. Dairy and livestock instructional material and equipment
(Set of milk testing equipment, hot plate, timer, column meter, record forms, computer, cleaning facilities, milk sediment tester, strip cup, potassium dichromate pills, methylene blue tester, emasculator, ear notcher, pig teeth nipper, swine back fat probes, veterinary thermometer, electric dehorner, sheep shears, wool card, trocar and cannula, clipper, feed samples, breed pictures, meat charts, judging score cards, preserved livestock parasite and disease specimens, hoof trimming equipment, tattoo equipment, livestock grooming equipment, livestock cane.)

Much of the above equipment and materials will be used and stored in the laboratory. Certain items will necessarily be found in the classroom, office-conference room, or a storeroom. Adequate storage of this departmental equipment is a necessity.

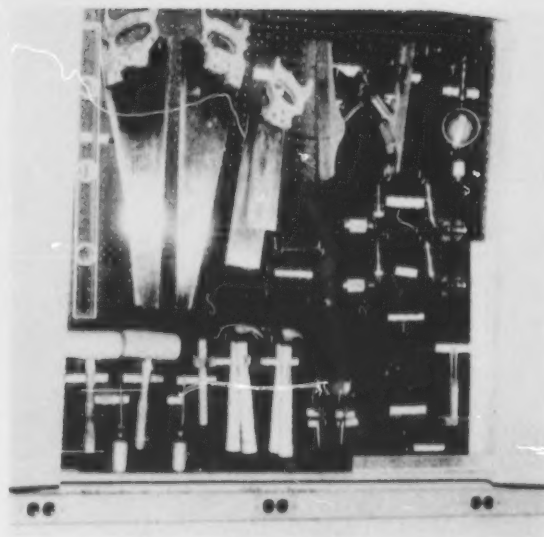


A present-day agricultural mechanics laboratory must be designed and equipped for a wide variety of study and work experiences in repair, maintenance and construction. Each laboratory should have electric control panels, floor drainage capacity near a large overhead service door, and an auxiliary door.

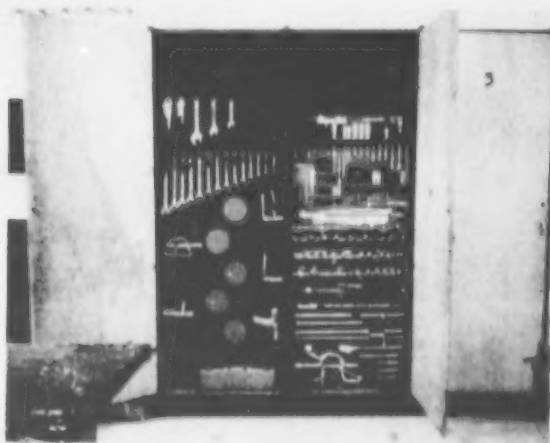




Pegboard is frequently used for mounting hand tools in wall-attached panels and cabinets such as the ones above and to the right. These cabinets and panels can be mounted over work benches to make tools accessible where work will be done.



The "A" type castered tool rack at the right makes tools accessible to any laboratory work area. Every laboratory tool should have a "place for storage" and be "in its place".



Agricultural Mechanics Laboratory

Space Needs The agricultural mechanics laboratory is a vitally important part of an up-to-date agricultural/agribusiness department. This laboratory provides students the opportunity to "learn by doing" under instructor supervision. If this learning is to be done efficiently and safely, adequate space and equipment is essential. It is well to recognize that repair, maintenance, and construction occur simultaneously in the laboratory. Space is needed for three main purposes:

1. Student work space
2. Equipment space and safe working area
3. Storage space

See section on "Computing Space Needed" in Part V for a method of determining the local needs of your community. A minimum of 2,800 sq. ft. of floor area has generally been accepted for single-instructor departments with a complete instructional program.

Many of the more recently constructed facilities are providing more adequately for space needs since enrollments are high and space for large equipment and machinery necessitates an expansion of facilities.

Another factor affecting space needs is whether or not the facilities will be used for other instructional programs in the school. If the shared space concept is in effect, a larger total space should be provided. Exclusive use of the laboratory in the vocational agricultural/agribusiness program is desirable. If an adequate program meeting the needs of youth and adults in the community is provided, the laboratory will receive full use.

Width-to-Length Ratio A width-to-length ratio not greater than 1-1/2 to 2 is recommended for the school agricultural mechanics laboratory. A long narrow laboratory is difficult to supervise and arrange. A well-proportioned laboratory saves steps for the instructor and the students, and makes tools and equipment more accessible to the laboratory work areas. Laboratories with a width-to-length ratio of 1:1.5-2 are desirable.

Laboratory Ceiling The ceiling in the agricultural mechanics laboratory should be at least 17 feet high.

A perforated acoustical board is a necessity for the laboratory ceiling to help reduce noises and improve teaching-learning-working conditions. The actual acoustical treatment should be discussed with an architect.

Laboratory Windows Window sill height in the laboratory is extremely important since it relates directly to efficient use of wall space below each window. Window sill height should be sufficient so that work benches and some equipment can be placed under them. Window sills should be sloped at a sharp angle, rather than being flat. Sloped sills will not accumulate tools, dust, shavings and other debris as will flat sills.

The size and placement of windows and the height of window sills and window heads should be planned to comply with the state lighting code for schools.¹⁸ Natural and artificial lighting are important in the laboratory and should be planned carefully with the aid of an architect. The minimum illumination permissible in the laboratory is presented in Table IV regarding intensity of artificial illumination.

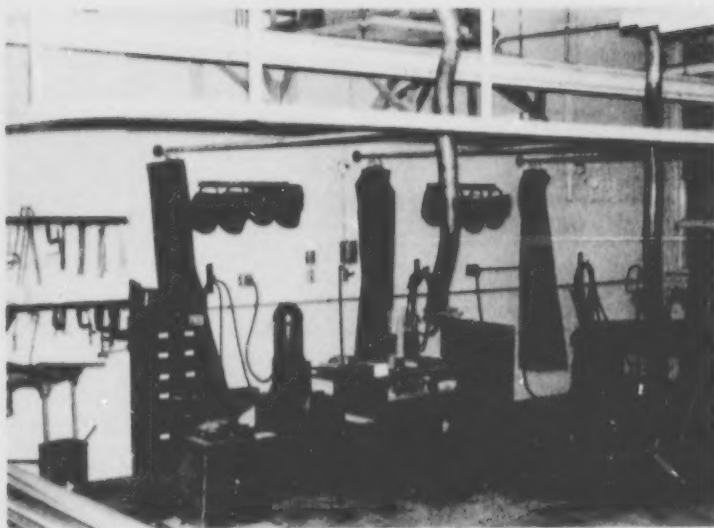
Windows should be grouped so that certain wall cabinets and tall pieces of equipment can be located along the outer wall. Wall space is very important in the agricultural mechanics laboratory. Heat loss should be considered when selecting the amount and types of windows.

Laboratory Floor Concrete makes the most satisfactory laboratory floor. In order for concrete to function properly as a flooring material, certain construction procedures must be followed. The floor should be smooth and level with the exception of the immediate area around the drain which is generally located near the overhead door. To prevent cracks, the floor must be supported on a well-drained granular sub-base, have built-in construction joints to control shrinkage cracks, and be thick enough to support the weights placed upon it. Reinforcement is less important than the sub-base, but will tend to prevent cracks that do appear from getting larger.

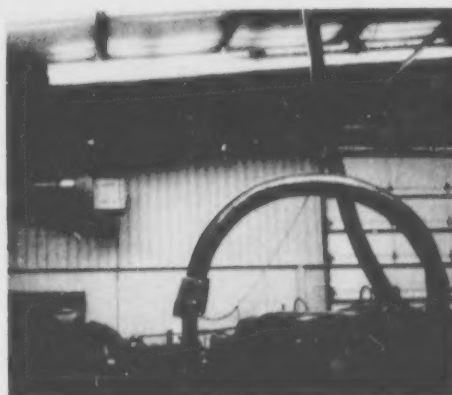
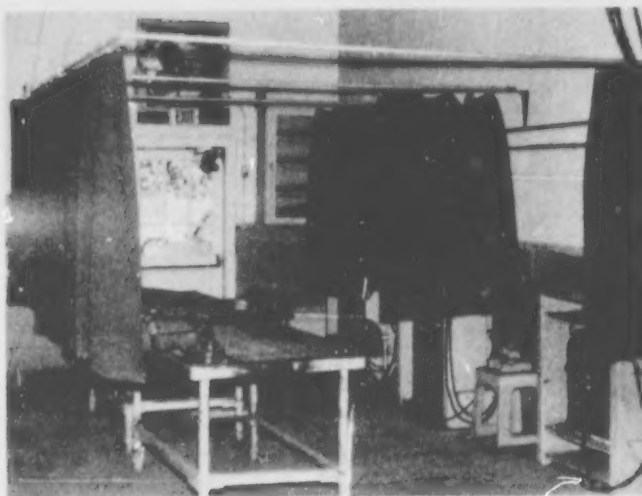
To insure a warm, dry floor, the slab-edge should be insulated with a "two-inch slab-edge insulation." This insulation can be installed either on the inside of the foundation wall and extending 2' 0" below grade or positioned horizontally immediately under the slab. It extends around the area where the floor contacts an exterior wall. The floor itself should be entirely above the outside finished grade line. A recommended vapor barrier under the slab and above the 6" fill will prevent vapor from entering and condensing in the concrete.

Special attention should be given to the quality of concrete that is poured and how it is placed, finished, and cured so the floor will be durable and free from dusting and chalking. Hardeners and sealers are available which will help correct a dusting condition, but the best assurance is to insist on recommended procedures for building concrete floors.

18. Wisconsin Administrative Code, Section Ind. 19.01, No. 178, loc. cit.



Welders should be provided in today's agricultural mechanics laboratory. Safety should be a foremost consideration. Ventilation and exhaust systems and safety features must be provided throughout the entire laboratory.





Small engine maintenance and repair instruction is best accomplished in a modern facility such as the one illustrated. Adequate work space for equipment and for students is an essential.



Agricultural mechanics laboratories should have a wide variety of equipment. Shown in the illustration above is a facility for washing engine parts in a safe manner. Well-arranged drill press, grinders, and other equipment provide a maximum opportunity for students to use such equipment in an efficient manner.



From a planning standpoint the laboratory floor area should be as free as possible of posts and pillars. These supports, while often necessary for structural purposes, do limit flexibility and vision in a laboratory.

Spray Painting and Steam Cleaning For departments where extensive spray painting is to occur, it would be well to provide a spray paint area, properly ventilated and screened from other laboratory areas. In a similar manner, when extensive agricultural machinery and equipment are to be studied from the point-of-view of repair and maintenance, steam cleaning equipment and space should be provided. It would also be well to provide a compressor and air hose facilities for tire inflation.

Ventilation A shortcoming of many laboratories is the inadequate performance of the ventilation system for the welding area. It fails to remove the smoke and fumes as required by the Department of Industry, Labor and Human Relations' code on "Dusts, Fumes, Vapors, and Gases" and "Safety and Health". Two reasons for this shortcoming seem to be (1) inadequately designed exhaust systems, or (2) improper use of the existing system.

The Code states that the area shall have an exhaust system capable of maintaining a negative pressure within the exhaust area.¹⁹

Two systems are currently in use for ventilating the welding area. One is a large hood with a fan in the exhaust duct. The other and more popular system has flexible tubes which provide individual ventilation at the welding table. The former (properly designed) will do a more effective job in preventing smoke from escaping to the laboratory, but does have the disadvantage of tending to pull smoke and fumes past the operator's face. It usually costs more. The latter does have the advantage of lower cost, and if properly used will pull the smoke and fumes away from the operator. If improperly placed during a welding operation, it may be relatively ineffective and let smoke and fumes escape into the laboratory. The flexible tube system permits moving a tube into the machinery repair area and may also be used for removing engine exhaust, particularly from engines with upright exhausts.²⁰

Flexible hoses connected to exhaust exits should be provided for the removal of engine exhaust in the machinery repair area. These hoses should be designed with a fan. Desired volume is 150 c.f./m.

Outside air intake openings shall be located so as to minimize contamination of outside air, but in no case shall the distance be less than 10' (measured in any direction) from outlets emitting products of combustion exhaust fans.²¹

19. Wisconsin Administrative Code, Sec. Ind. 64.18, No. 276, loc. cit., p. 270.

20. In Wisconsin, see Wisconsin Administrative Code, Ind. 1000-2000 (1910.252) No. 236, loc. cit., pp. 237-249.

21. Wisconsin Administrative Code, Sec. Ind. 64.19, No. 276, loc. cit., p. 271.

Electrical Outlets Electrical needs in a laboratory require a good deal of careful planning. A first requirement is to determine the equipment layout so that the proper kind of service can be supplied where it is needed. This planning phase should precede construction so the electrical service will be "built-in." Both single-phase and three-phase current is desirable since three-phase motors of large horsepower cost less initially and to maintain than do single-phase motors. The cost to install three-phase current may be expensive in some localities.

Convenience outlets should be located above work bench tops and throughout work areas at intervals of not more than 10 to 12 feet. With the increasing use of electricity, more frequently spacing is suggested. All stationary power tools using single-phase one-half horsepower or larger motors should be wired for 220 volts since this reduces the wire size and its cost. Special wiring is needed for the arc-welder. Be sure to locate an arc-welder outlet near the overhead door.

Location of floor outlets needs to be studied carefully. The recessed, waterproof floor outlets generally have proven more satisfactory than those projecting up from the floor since they permit more flexibility in equipment location. The projecting type outlets are a hazard when standing alone since people may trip over them.

For some uses the overhead recoil type outlets may be practical. They are very flexible and when not in use will retract out of the way. For tools where areas above working height need to be clear they are not practical--such as table saws. Some people object to the appearance of these drop cords.

Laboratory Tool and Small Equipment Storage Adequate storage must be provided for hand tools and small equipment. The three basic facilities currently being used for such storage are:

1. Wall panels and cabinets
2. Portable, castered racks
3. Tool and equipment storage room, either within the laboratory floor area or a small adjacent room

All three types can provide for locking items in storage, if this is desired.

Wall panels and cabinets located in the various work areas in the laboratory are preferred. Such storage allows students access to tools and equipment which are related to their particular project or activity.

Frequently, a combination of wall panels and cabinets and portable tool racks is used for storage of hand tools and equipment. Portable tool racks are generally "A" type with tools mounted on both sides and some equipment

placed inside either in small drawers or laid on the bottom of the rack. These racks can be pushed to any location within the laboratory.

If a tool equipment storage room is used, it might be made simply of heavy gauge wire and pipe construction if located within the laboratory area, or of normal construction if the room is a separate one of 100 sq.ft. or more. Tool mounts, shelving, drawers, etc. should be provided in the tool room to give organization and efficiency in use of all tools and equipment. Sufficient space for hardware and other items must be provided. Generally, a student is assigned to check out items from this room (on a rotational basis) and to maintain and organize items when classes are in the laboratory.

Many instructors justify a tool equipment storage room on the basis of fewer losses of small tools and equipment. However, tools and equipment can be locked in panels, cabinets, or racks with hinged doors. Tool rooms are not as highly recommended today as are wall panels, cabinets and portable racks.

Equipment-mounted panels and cabinets can be provided easily for such items as a tilting arbor saw and lathe; for example, a small shallow panel can be constructed for the tilting arbor saw. Such a panel can be attached to the rear of the base of the saw. Extra saw blades, dado heads, special wrenches, etc. can then be stored in the panel, handy for changes and adjustment, and safely locked when not in use.

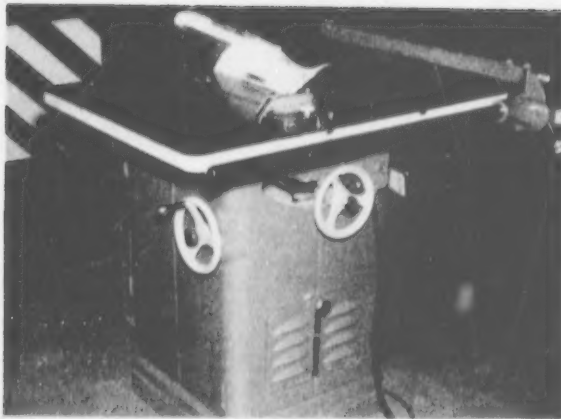
Location of tools and equipment in appropriate work areas of the laboratory provides maximum efficiency of student and teacher time. It also creates a safer environment since students do not have to move through several work areas to get a particular tool or small piece of equipment.

Overhead Service Door, Patio, and Auxiliary Door The overhead service door must be large enough to accommodate machinery and equipment used on today's commercial farms. It is recommended that these doors be 16 - 18 ft. wide and at least 14 ft. high. Insulated doors should be considered.

The overhead door should be located on the south or east side if possible. In rectangular-shaped laboratories, the placement of the overhead door in the end wall generally allows for good internal arrangement of the various work areas.

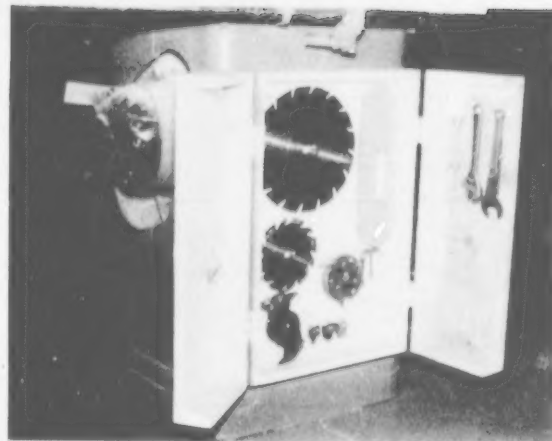
If the laboratory floor is slightly below grade (while not recommended), a drain should be placed at the foot of the ramp outside the large door. Another drain should be located several feet inside the overhead door.

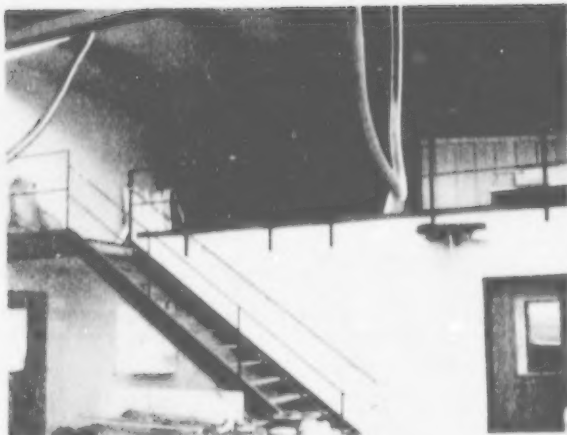
The drive to this overhead door and the adjoining area should be surfaced. Students can work on such a surfaced area when weather permits. A regulation size walk-in door should be provided near the overhead door.



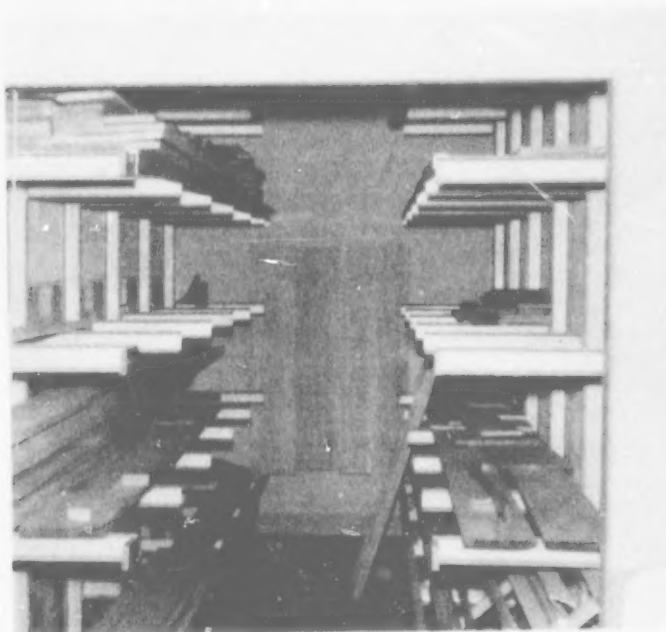
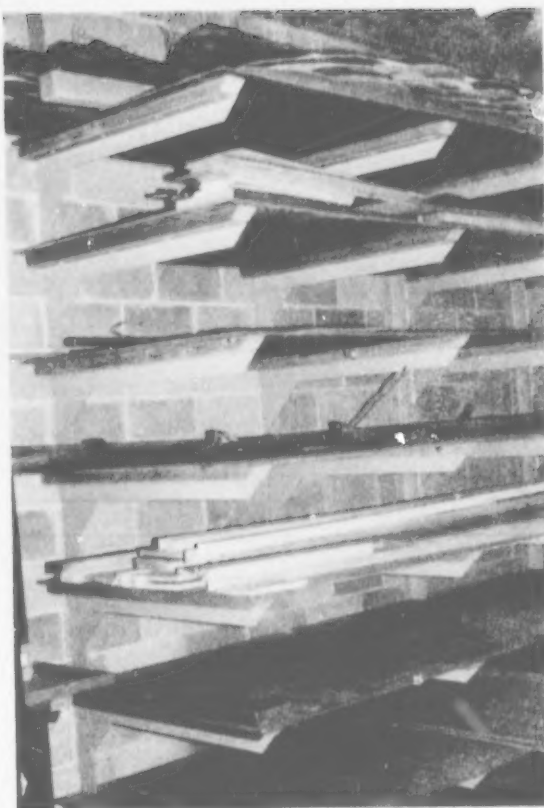
Shown in these illustrations are typical pieces of equipment in the agricultural mechanics laboratory. Note the auxiliary storage cabinet mounted on the table saw, the electrical outlets over the wall-mounted work benches, and the waterproof receptacles in the laboratory floor which provide flexibility in equipment location. Clean conditions provide a safer learning environment.

To provide for maximum safety while the laboratory is not being used for supervised instruction, master control facilities for the electrical services to equipment should be provided. In this way, the instructor can deactivate equipment by simply turning off electrical power.





An overhead storage area with an appropriate stairway provides auxiliary space. Storage racks for metal and lumber can be provided in adjacent rooms or wall-mounted structures, or castored racks as shown.



Work Benches Work benches frequently are placed along certain parts of the walls. Bench grinders, drills, etc. are sometimes mounted on some of these benches. In the sheet metal and welding areas, metal top work benches are desired. In the woodworking area, wood tops should be used.

There are three types of work benches generally used in agricultural mechanics laboratories:

1. Work benches attached to walls with angle braces and having castered supply racks underneath which serve as portable lumber and metal storage racks.
2. Work benches attached permanently to the floor; some storage provided underneath but not as flexible as one above.
3. Portable work stations which can be moved easily.

Portable work stations equipped with vises are gaining prominence due to their flexibility in laboratory arrangement. At the same time, the wall-attached work bench with the castered supply racks underneath are proving quite satisfactory. This type of bench helps to keep the floor area unobstructed. If this type of work bench is contemplated, attention should be given to wall strength and means of attachment.

Work benches generally are 18-30 inches deep, 6-8 feet long, and 34-36 inches high. The actual size and placement of any work bench depends upon its use and the location of other items.

Chalk Board and Bulletin Board A portable chalk board is useful in the laboratory. A permanently mounted one uses valuable wall space. A 4' x 4' or 4' x 6' portable chalk board should be satisfactory.

A bulletin board located at the entrance used most frequently by students can be valuable to the mechanics program. Laboratory assignments, safety slogans and posters, pictures and other items can be posted.

Lumber and Metal Storage Lumber storage frequently is provided in the following ways:

1. Castered rack underneath wall-attached work benches
2. Upright storage rack designed for convenient lumber handling
3. Balconied storage
4. Lumber-metal storage room

Where wall space is available, the wall-attached work benches with racks underneath are useful. The upright storage rack provides greater capacity generally, can be free-standing, and can be placed along any available walls. The balcony storage is not as convenient as the first two above; if present, it can be used for storage of overflow and seldom-used items. The lumber-metal storage room can be costly. The extra cost for a separate room for storage of lumber and metal only makes this arrangement questionable.

Generally lumber racks would have a maximum height of 7 ft. and be 10-16 feet long, and 18 inches wide if access is from one side only.

Metal storage racks can be welded from angle iron with a flat storage area underneath for short metal and pipe stock, with cross members at the top tiers for longer stock. The metal storage rack should also be placed at one side of the laboratory, near the metal work area and welding area. The size of such racks should be determined on the basis of metal to be stored in the department for teaching purposes.

Hoist Provisions A movable hoist can be extremely useful and provides wide use for hoisting equipment and machinery inside and outside the school laboratory. If lifting heavy items is anticipated, a hoist should be provided. Since most of the recently constructed laboratories have steel beam construction, a chain hoist can frequently be attached to a beam. Such a beam should be designed to carry this additional load. Provisions should be made to swing the hoist to a wall and attach it securely when it is not being used.

Seating Equipment Provisions Seating for group demonstrations is important. The seating equipment should be such that it might be easily moved without much energy or loss of time. Often the adjoining classroom may be used for group instruction when seating is necessary.

First-Aid Cabinet and Fire Extinguishers A large first-aid cabinet is a must. It should be located easily accessible to all students. The location of the first-aid kit should be clearly marked. If removed for any use, encourage its immediate return so it will always be available.

Fire extinguishers of an appropriate type and size should be provided for the laboratories and other vocational rooms. Fire extinguishers should be prominently displayed and always accessible. For general protection throughout the school, one extinguisher should be provided for each 2,500 square feet or fraction of floor area.²²

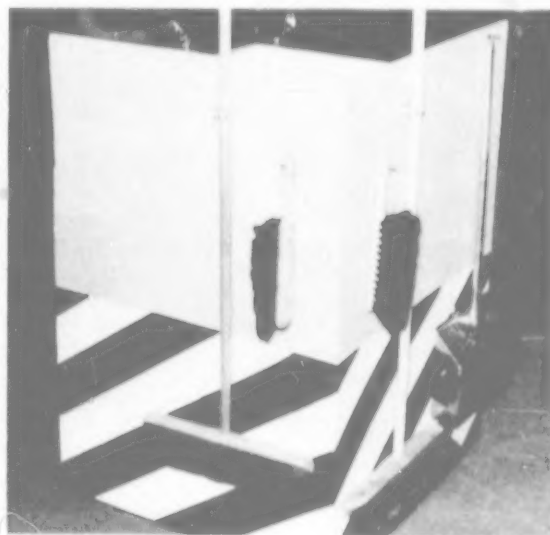
22. Wisconsin Administrative Code, Ind. 56.18, No. 276, op. cit., p. 195.



Students should use safety glasses when in a laboratory either observing or operating drill presses and other laboratory equipment. Appropriate storage of safety glasses can be provided in a wall-mounted cabinet. Instructors should always require that students use safety at all times when in a laboratory.



A clean-up cart with brooms, brushes, and dust pans attached aids in maintaining a safe laboratory. A semi-circular wash basin can permit students to quickly clean their hands at the end of a laboratory period.



Wash Facilities in Laboratory Semi-circular industrial-type wash basins have proven quite satisfactory. Such a basin provides a spray of water which allows several students to wash at the same time. It is self-cleaning to some extent due to the continuous spray of water to the outer edges when in use. It should be located near the student locker area or the cleaner portion of the laboratory. Adequate storage of paper towels and disposal for used towels should be provided. A drinking fountain is desirable near the wash basin. These facilities should be selected to accommodate the disabled.

Color Conditioning Laboratory and Equipment Colors for the walls and ceiling should meet the specification previously presented in "Painting Permanent Structures."

The use of color dynamics with equipment for safety purposes is being increased gradually. Students must be educated to the purposes of the various colors used and the functions they perform in the safe operation of equipment.

Six basic colors are currently used in color conditioning equipment. It is recommended that the following colors be used.

<u>Color</u>	<u>Equipment Parts to Which Color is Applied</u>
Ivory - - - - -	Working edges
Safety green - - - - -	Body(base) of machine and non-critical parts
Highly visible yellow - - - - -	Adjusting knobs, handles, operating controls
Orange - - - - -	Dangerous areas, parts that crush, cut, shock, injure, exposed parts
Red - - - - -	Fire protection; combustible substance containers
Blue - - - - -	Electrical switches

Yellow and black strips are recommended for pointing out dangerous obstructions--for low entrance ways, high steps, etc. Green and white are frequently used to indicate the location of first-aid materials.

A color filmstrip entitled, "Use of Color in a Farm Mechanics Shop" is available.²³ This filmstrip could serve as a guide for color conditioning.

23. This filmstrip is available from: Vocational Agriculture Service, University of Illinois, Urbana, Illinois.

The emphasis on color dynamics is primarily one of safety and should not be overlooked in reducing liability for the laboratory instructor.

Another important aspect of color in the laboratory is the color code system to emphasize certain features for safety or identification. The following is the system developed by Pittsburgh Paints.

Pittsburgh Color Dynamics

- A. Machines, stands, bases, other equipment
 - 1. Main body--vista green
 - 2. Electrical switches--focal orange
 - 3. Focal areas (e.g., the table insert on saw)
 - a. Woodworking machines--focal orange
 - b. Metalworking machines--focal ivory
 - 4. Handwheels (except rims)--focal beige
 - 5. Levers (except handles)--focal beige
 - 6. Dangerous projections (e.g., a flywheel)--focal yellow striped with focal black
- B. Walls, partitions, columns, trim--medium to light green
- C. Doors--natural wood finish or vista green
- D. Ceilings--white, off-white, cream, ivory, or very light green
- E. Floors--natural wood finish or medium gray
- F. Color coding for safety
 - 1. Watch out--focal yellow striped with focal black. Warns against falling, stumbling, and projecting hazards. Four-inch focal yellow stripes on floors mark traffic lanes and danger areas around machines.
 - 2. On guard--focal orange. Warns against dangerous parts and areas of equipment. Included are electrical switchboxes, machine guards, the insides of fuse box and circuit breaker box doors, and the areas around crushing and cutting edges.
 - 3. Fire protection--red. Marks the location of fire fighting equipment and identifies the individual pieces such as fire extinguishers.
 - 4. Out-of-service--blue. Blue disks are hung on pieces of equipment that are not to be used. "Out-of-order" is lettered in focal white on the focal blue background.

5. First-aid--green. Marks the location of first-aid supplies. A white cross on a green background further identifies a first-aid cabinet. Entrances to first-aid stations are identified by white crosses bordered with green.
6. Housekeeping facilities--white. Painted areas of floors indicate locations of waste receptacles. Temporary floor storage spaces are outlined by four-inch white stripes.
7. Pipe line identification
 - a. Fire protection materials (e.g., sprinklers)--red
 - b. Dangerous materials (e.g., acids, gases)--yellow or orange
 - c. Safe materials (e.g., drinking water, compressed air)--green, light gray, white, dark gray, or black
 - d. Protective materials (e.g., gases or liquids used as antidotes to dangerous materials)--blue
 - e. Extra-valuable materials--purple

Note: The pipe should not be painted along its entire length but at intervals; the rest of the pipe should be painted the color of the surface to which it is adjacent.

Arrangement of Work Areas and Equipment The various work areas and equipment within the laboratory should be arranged so that wall space, floor area, lighting and ventilation will be most efficiently and safely utilized. The laboratory should be arranged so that as much open floor area as possible is allowed for student work space. Generally, this open area should be in the central portion of the laboratory and lead to the overhead service door.

One procedure for arranging work areas and equipment is to:

1. Designate areas of instruction (hot and cold metal, welding, machinery maintenance and repair, woodworking, general work area, finishing and painting, electrical work).
2. Place welders where exhausting will be available, generally in the vicinity of the overhead door. Metal and machinery work areas will then be in this general vicinity.
3. Locate woodworking area and equipment away from the overhead door possibly at the opposite end or wall area, depending upon the size and shape of the laboratory. Place the major pieces of power equipment such as circular saw, jointer, radial arm saw and others within the area, providing a "flow" of operations or processes involved in woodworking.

4. Locate electrical area, sheet metal, etc. along the remaining wall space. Work benches can be placed along the walls if appropriate, with tool panels and cabinets above them where work of a specific nature is to be performed.

In general, the "cleaner" type of work should be separated from the welding-forging area. Such equipment as a heavy duty grinder and a power-hack saw naturally would be located convenient to the forge and welding area.

Care should be taken to provide an open floor space where larger construction and repair work can be accomplished.

It is important to keep in mind that adequate work area for each piece of equipment is a necessity. Minimum distances from one piece of equipment to another on the basis of use and safety should be established. (See Table III and plan cutouts in Part IV.)

The layout and organization of the laboratory depend upon the actual equipment in each local department. Adequate storage and good arrangement of the equipment is imperative if a safe, efficient program is expected.

Agricultural Mechanics Laboratory Equipment Schools should purchase good quality equipment for the agricultural mechanics laboratory. Providing quality tools and equipment contribute to the safety of individuals as well as to operational efficiency. There is, however, no substitute for careful operation and protective guarding for parts of equipment which may cause injury to a person. The Department of Industry, Labor and Human Relations rules pertaining to safety and health for agricultural mechanics equipment should be secured to assure that standards are met.²⁴

Equipment suggested for agricultural mechanics laboratory teaching includes:²⁵

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24. Wisconsin Administrative Code, Section Ind. 1.01-1.86, No. 196, loc. cit., pages 1-39.
 25. In Wisconsin, for descriptions, recommended quality and recommended numbers of a more detailed list of suggested minimum agricultural mechanics equipment, secure current information from the Wisconsin Department of Public Instruction, Division of Instructional Services, Bureau for Career and Vocational Education. Madison, Wisconsin 53702.

1. Power Equipment

(Portable electric drills, bench-type tool grinder, heavy duty pedestal grinder, tilting arbor saw or radial arm saw, power plant sprayer and compressor, jointer, power hack-saw; floor model or 15" bench drill press, power hand saw, portable 3" belt type sander, orbital sander, sabre saw, sickle grinder, planer, portable grinder-optional and paint respirator)

2. Farm Carpentry

Types of tools and equipment needed (files, auger bits and braces, nail and ripping hammers, broad hatchets, squares [combination, try and mitre, framing], gauges, steel tapes, carpenter's level, planes [jack, smoothing, block], saws [cross cut, rip, coping, hack, etc.], screw drivers [philips, etc.], woodworkers' vises, wing dividers, trammel point, saw horses, wrecking bars, combination oil stones, slip stones, oilers, grinding wheel dresser and cutters, cabinet scrapers, draw knives, nail sets, carpenters' mallets, set stamp letters and figures, lumber rack, scrap containers, slim taper files, file card, assorted file handles, paint brushes, chain saw reconditioning tools, drawing boards, drawing rulers, T-square, plastic triangles, rafter template adjustable, etc.)

3. Hot and Cold Metal Work

(Anvil, hardies, cold cutters, machinists' vises, drill press vise, blacksmiths' and engineers' hammers, straight and ball pein hammers, bolt cutters, cape chisels, cold chisels, center punches, adjustable hack-saw frames, files, high speed twist drills, metal stands for drills, combination screw plates [taps and dies], outside and inside calipers, center gauge, steel rule, micrometer, screw extractors, drill press vises, hot cutter, round and square punches, blacksmiths' sledge, flat and round lip tongs, double forge or gas forge, forge blower, blacksmiths' leg vise, bolt cutters, files [flat bastard, round bastard, flat smooth], rack for iron, etc.)

4. Concrete and Masonry

(Brick trowels, plastering trowel, concrete edger, concrete jointer, shop-made concrete floats, ball cotton, chalk lines, star drills, sand riddles, fluted rubbing brick, mixing box, measuring boxes, tamper, slump cone, square pointed shovels, etc.)

5. Farm Machinery and Power

(Manual chain hoist, spur geared safety hoist, starter punches, machine punches, pin punches, long taper drift punches, guard and sickle anvil with rivet set, wheel and gear puller, service lights, socket wrench sets, box end wrenches, straight wrenches, open end adjustable wrenches, allen wrenches, vise-grip wrenches, tappet wrenches, slip joint and cotter key pliers, melting ladles,

pressure grease gun, oilers, hydraulic jack, tension wrench; steam cleaner-optional, gas can with pressure cap, torque wrench, parts washer, wire brushes, thickness gauge, spark plug gap gauge, spark plug wrench, timing light, compression gauge, battery carrier strap, battery charger, battery booster cable, ignition wrench set, combination wrench set, bearing puller, ring compressor, valve spring compressor, tachometer tester, cylinder ridge reamer, cylinder hone, barrel for waste oil, tire gauge, metal vise, groove piston vise creepers, volt-ampere tester, vacuum and fuel pump tester, valve grinder, valve knurling kit, valve seat grinder, metal lathe, tachometer, stopwatch, hydraulic training bench with an electric driven hydraulic pump, valves, cylinders, hoses, pipes, tubing, hydraulic units (power steering, etc.)

6. Soldering and Sheet Metal
(Propane blow torches, bench gas furnace, electric soldering irons, soldering coppers, soldering copper handles, soldering gun, tinners' snips, bench shears, hand seamers, tinners' riveting hammer, rivet sets, tinners' awls and mallets, steel brush, solder flux, etc.)
7. Arc Welding and Oxy-Acetylene Welding and Cutting
(Two-stage oxygen and acetylene regulators, welding torch, mixing heads, welding tips, cutting torch, cutting tips, oxygen Y-connection, acetylene Y-connection, twin hose, face shields, shop made cylinder truck, spark lighters, shop made oxy-acetylene welding tables; A.C. arc welders, spot welder, acetylene welder, tig welder, wire welder, welding helmets, portable welding screen, welding hand shields, vise-grip welding clamps, combination wire brush and scrapers, tomahawk, shop made arc welding tables and electrode holders, metal scrap boxes, adjustable "C" clamp, ventilating equipment)
8. Farm Electricity
(Lineman's side cutting pliers, long nose pliers, oblique cutting pliers, linoleum knives, American standard wire gauges, locally made electric panel)
9. Plumbing
(Pipe vises, adjustable pipe stock, pipe cutter, pipe reamer, pipe wrenches, pipe threaders, copper tubing equipment set, etc.)
10. Painting and Glazing
(Putty knives, paint scrapers, paint brushes, stencil brushes, adjustable stencils, figure stencils, letter stencils, number stencils, glass cutters, etc.)

11. Land-Engineering
(Tripod levels, surveyor's rods, surveyor's arrows, chain tapes, hand-sighting level; hand level-optional; transit, shovel, stakes)
12. Safety and First-Aid
(First-aid kits, face shields, fire extinguishers, safety goggles, marked containers, underwriter-approved fire blanket, etc.)
13. Miscellaneous Equipment
(Chain saw, air compressor, tool storage cabinets, hardware storage cabinet, paint storage cabinet, tractor dynamometer, spray paint booth, etc.)

It is obvious that if equipment listed above is to be readily accessible for use, that efficiently planned and organized storage is mandatory. Care should be taken that this equipment is used and maintained safely in an educationally sound agricultural mechanics laboratory instructional program.

The Greenhouse

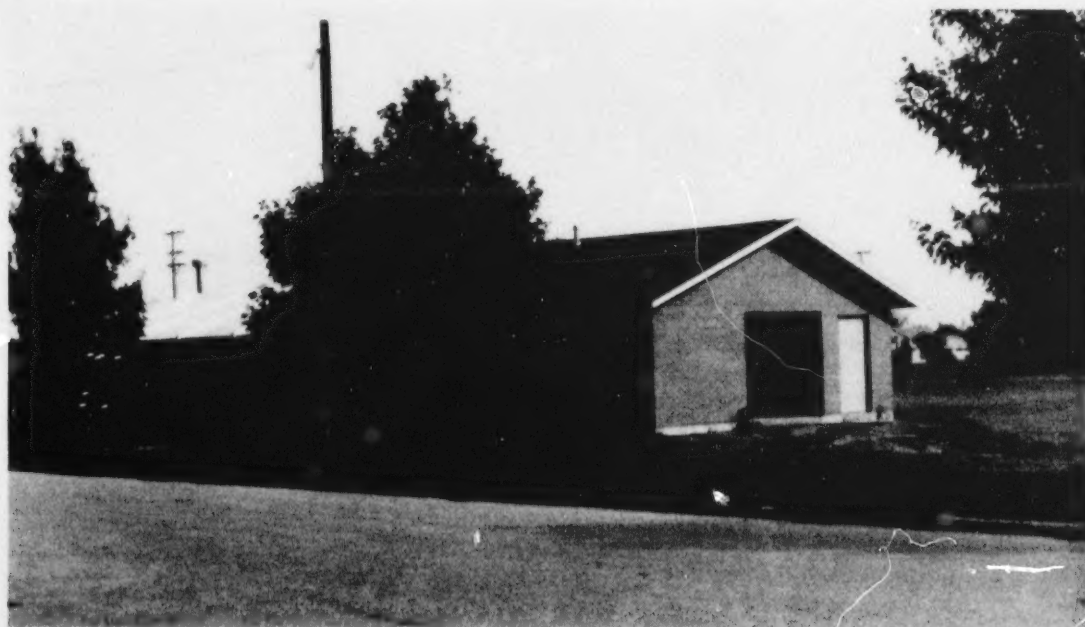
Introduction An important agribusiness and environmental employment area that is emerging is ornamental horticulture. To meet the demand for trained persons in these occupations, schools must have adequate facilities. Facility planning can be effective only if it is correlated with the institutional program to be offered.

Any school contemplating the addition of a greenhouse to its laboratory facilities must, in addition to making a needs assessment for this phase of the program, take into consideration the staff resources needed. The plants in the greenhouse are alive and growing under very controlled artificial conditions. This means that someone has to be available to make sure that proper temperature, light, and humidity is maintained at all times. Normally, this means someone has to be available every day, including Saturdays and Sundays for effective use of the unit.

Choosing a Location The first consideration in locating a greenhouse is that it has sufficient sunlight. Normally, the south side of the main building (if it is not free standing) is more desirable. A greenhouse in other locations will receive either morning or afternoon shade which will inhibit plant growth.



A greenhouse laboratory with a headhouse located closely to the main school building is most convenient for students and staff. A headhouse should be constructed to provide adequate access. Note in the illustration below the overhead door and an auxiliary door.



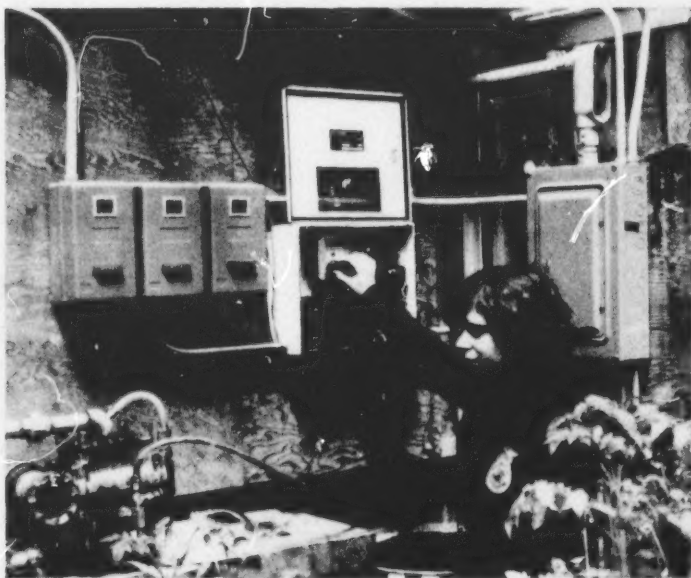
The Structure The best structure that can be assembled is an all-aluminum frame greenhouse, from the standpoint of maintenance, upkeep and longevity. There are several greenhouse construction companies in this country including: Lord & Burnham Company, Irvington-on Hudson, New York, 10533; Rough Brothers Greenhouses, 4229 Spring Grove Avenue, Cincinnati, Ohio, 45223; Ickes-Braun Greenhouses, P. O. Box 147, Deerfield, Illinois, 60015; and National Greenhouse Company, Pana, Illinois, 62557. Most greenhouses come standard widths, for example, 21'-2", 24'-7 1/2", 28'-1", etc., with standard eave heights of either 6' or 7'4", etc. They are also usually purchased in certain lengths of so many feet per module, normally consisting of lengths in multiples with 10'- 3 3/4" base and consisting of five lights of 24" glass. The type of greenhouse that is usually purchased is a clear span greenhouse which indicates there are no posts in the middle of the greenhouse that would obstruct working activities.²⁶

One of the first considerations when designing a greenhouse is the need for more than one room or compartment. The minimum number of compartments should be two in order to grow both 50° and 60°F night temperature plants. There are instructors who have developed a plan with four different compartments--two compartments being larger than the other two. The two smaller compartments are used for propagation of plants and identification of plant material, and the larger compartments used for growing 50° and 60°F night temperature plants.

How much greenhouse space should be provided depends upon the long-range view of the department. If the horticultural option is located in an urban area, there is good reason to expect a large enrollment.

Heating The two main methods for heating a greenhouse are either by hot water or steam. The heating system of the greenhouse is usually in conjunction with the heating system of the high school, and in most cases the heating system will be hot water. When a commercial greenhouse is built, the normal method of heating a greenhouse is by steam. One of the disadvantages of having the same heating system for the greenhouse and the high school is that the temperature inside the high school is reduced during the weekends, and this does not usually produce a satisfactory growing situation for greenhouse plants. Secondly, high school vocational agriculture instructors will want to pasteurize or sterilize soil. It is impossible to sterilize soil with steam when the heating system is hot water, and it is necessary to purchase several pieces of soil sterilizing equipment so the instructor can efficiently and effectively sterilize the soil.

26. Richard S. Lindstrom and Raymond E. Campbell. "The Development of a Greenhouse Complex in a Vocational Agriculture Education Program for Virginia High Schools and Vocational Technical Schools". Virginia Polytechnic Institute and State University, Blacksburg, Virginia.



Each greenhouse and head-house facility requires adequate environmental controls. The panel to the left shows control mechanisms.

The interior of a greenhouse should be well-arranged, well-equipped, and have provisions for water, for heating, and for ventilation.





These illustrations are designed to depict functions such as students disinfecting greenhouse pots, using a soil conditioner, working at a potting bench.



The Headhouse²⁷ Generally, the preparatory work takes place in the headhouse before the plants and flats are moved into the greenhouse, so if it is not provided, comparable space will have to come from existing facilities at the expense of other activities.

The headhouse should have at least 300 square feet of floor space with the following features:

1. Adequate storage space (minimum of 300 square feet)
2. A soil mixer
3. A soil sterilizer
4. A refrigeration unit of at least 30 cubic feet
5. A deep sink (at least 10" deep)
6. A stainless steel double sink
7. Adequate floor drain
8. Work bench and table space of 16-20 linear feet
9. An 8' overhead door
10. Storage containers for soils, vermiculite, perlite, etc.
11. Separate temperature control

The Greenhouse²⁸ The greenhouse should have at least 500 square feet if it is to be used as a demonstration learning center, and at least 800 square feet if it is being used as a production-learning center. Items to be considered in planning include:

1. Have two separate areas with separate climate control
2. Each compartment should have separate heat, cooling and humidity control units.
3. Crushed rock should be provided beneath the benches
4. The greenhouse should be located to expose it to the maximum available sunlight.

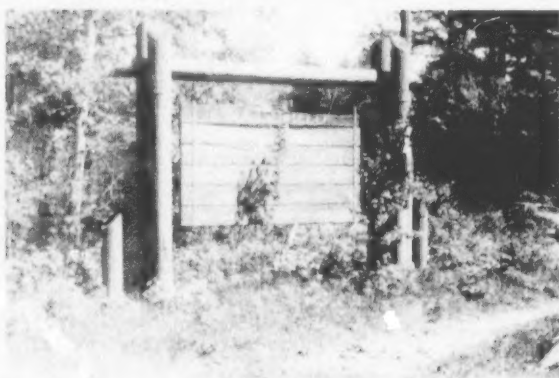
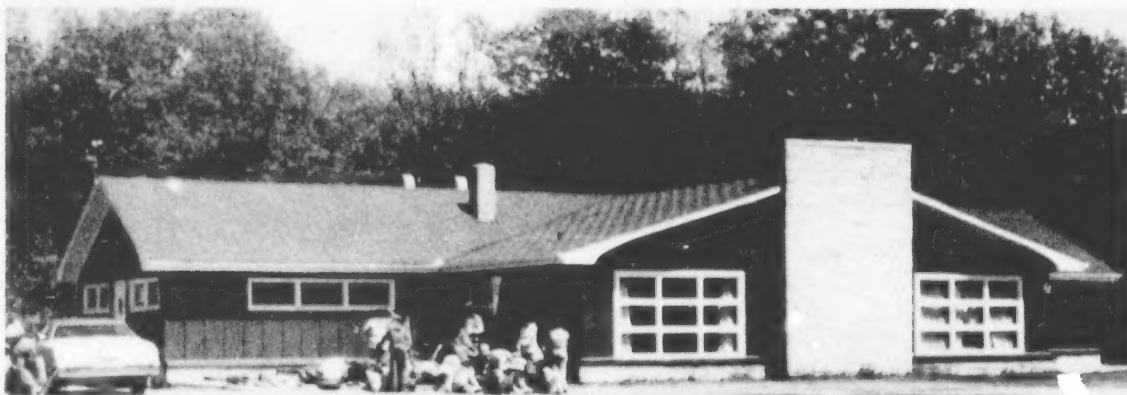
27. Adapted from W. Forrest Bear and Thomas A. Hoerner, "Planning, Organizing, and Teaching Agricultural Mechanics." Hobar Publications, 1305 Miller Lane, St. Paul, Minnesota 55112. pp. 94-95.

28. Ibid.

References

For more detailed information or individual items, planners are directed to the following references:

- a. Facilities for Instruction in Ornamental Horticulture. The Pennsylvania State University College of Agriculture, Dept. of Agriculture Education, Teacher Education Series Volume 12, No. 3, 1971.
- b. "Suggested List of Equipment for a Vocational Agriculture Program in Horticulture for Virginia", Virginia Polytechnic Institute, Blacksburg, Virginia, 1973.
- c. Bear, W. Forrest, and Hoerner, Thomas A., Planning, Organizing, and Teaching Agricultural Mechanics. Hobar Publications, 1305 Tiller Lane, St. Paul, Minnesota 55112. pp. 94-95.
- d. Lindstrom, Richard S. and Campbell, Raymond E. "The Development of a Greenhouse Complex in a Vocational Agriculture Education Program for Virginia High Schools and Vocational Technical Schools". Virginia Polytechnic Institute and State University, Blacksburg, Virginia, 9 page monograph.



Land laboratories such as school forests, arboretum areas, nature trails, horticultural gardens, and experimental crop production plots are becoming important parts of educational programs. Access to such facilities is a must. Headquarter facilities and trail signs are highly desirable.





Land judging and soil study can be accomplished through effective use of land laboratory areas. Also, environmental centers or areas in close proximity to the school are convenient for student use.



Land Laboratory

Types of Land Laboratories There are several types of land laboratories in operation among vocational agriculture/agribusiness departments, including: conventional school farms, school forest, wetlands study areas, horticultural gardens, arboretum area, orchard plots, landscape areas, turf plots, nature studies area, plant materials beds, experimental crop production plots, etc. Land laboratories might be used for a variety of educational purposes: (1) observational by all students, (2) occupational learning in production crops for the non-farm and urban background students, (3) demonstrational teaching, and (4) production-sales to help support other departmental functions.

Scope and Size of Land Laboratories Many factors enter into the determination of the scope and size of land laboratories. Foremost among the factors should be the educational role intended for the laboratory, whether for demonstrational teaching and/or occupational learning/skills development. The acreage in a land laboratory will be influenced by local availability, distance from the primary school site, cost for purchase, cost for maintenance and operation.

Desired Location If at all possible, a land laboratory should be immediately adjacent to the school and near the horticultural-greenhouse facilities, if such are provided.

Operation of Land Laboratory For a successfully operated land laboratory, it is mandatory that sufficient extra time is allocated among the agricultural/agribusiness instructor staff. Careful planning, use and operation are essentials for a land laboratory to make the most meaningful contribution to a school's educational program. It should not be expected that an instructor's time be devoted to performing maintenance functions. An instructor's time should be devoted primarily to directing occupational learning activities and programs. Dependent on the size of the land laboratory, it might well be essential that either full-time or part-time employees be hired to do the greater share of maintenance and production work.

Storage Facilities At the site of a land laboratory, dependent on the educational purposes to be served, storage facilities for supplies, equipment, chemicals, etc. should be provided. Separate locked storage facilities for any chemicals which are to meet OSHA and EPA standards should be provided.²⁹ Storage "on site" is desirable to eliminate needless

29. Wisconsin Administrative Code, Ind. 1000-2000, No. 236, loc. cit., pages 327.



A land laboratory should be used primarily as an instructional resource for occupational learning for students. Students interested in commercial agricultural production can learn much from experimental plots and from machinery operation and maintenance.



time delays, transportation problems and to assure economy of usage. The size and nature of storage facilities will depend on type and amount of equipment, machinery, and other materials needed in the educational program. Storage facilities might range from a small shed to an extensive building complex.

Equipment Associated with Land Laboratories Since the type of land laboratory might vary widely from one school to another, dependent on the educational needs of students to be served, it is difficult to provide an encompassing equipment list; however, the following items are indicative of the types of equipment which are likely to be found at school land laboratories: pruning saws, pruning shears, moisture tester, lopping shears, grafting materials and tools, forage sampler, pots, peat and potting materials, automatic watering unit, flats, watering cans, garden rakes, garden hoes, spades, spading forks, hoses, sprinkler, sprayers, wheelbarrow, tree planting bar, grub hoe, Roto-tiller, soil sampler, barn shovel, sod cutter, level and tripods, soil test kit, soil auger, budding knife, axe, tin snips, claw hammer, water gun nozzles, long handled spade, diamond point spade, transplanting spade, bulb planter, post hole digger, seedling setter, sod lifter, nurseryman's hoe, weeding hoe, small cement mixer, bow saw, utility hand truck, step ladder, knee pads, soil sterilizer, land measuring wheel, fertilizer injector, lights, shade material, mounted specimens of insects and insect damage, samples of insecticides and fungicides, crop samples showing diseases and fertilizer nutritional deficiencies, soil profiles-monolith, set for soil capillary demonstration, pressed weed mounts, tractor and machinery, as required, etc.

Function: A land laboratory, regardless of its type, should be viewed as having one primary function: AS AN INSTRUCTIONAL RESOURCE, PRIMARY FOR OCCUPATIONAL LEARNING FOR STUDENTS AND FOR DEMONSTRATION TEACHING.

PART VI

EFFECTIVE BUILDING AND FACILITIES USE

Instructor's Responsibility

The only basis for justifying adequate facilities in the final analysis is the educational program which is made possible. It is the instructor's responsibility to take full advantage of the educational opportunities in the school community.

The instructor in vocational agriculture/agribusiness, working cooperatively with persons in the community, has the responsibility of determining, planning, conducting, and evaluating a sound vocational education program for the school and the people it serves.

The facilities which the community provides must be used by the instructor to help assure the most effective educational program possible for the students of all age levels and occupational background in the community.

Using Resources Wisely

Instructors of agriculture/agribusiness have a unique opportunity educationally in that instruction of students occurs not only in the classroom, but in a variety of laboratories: general laboratory, agricultural mechanics laboratory, horticultural greenhouse laboratory, and a wide variety of land laboratories, as well as on farms of students, and at other sites for occupational training. All of these resources are extremely important to enable students to achieve a broad basic education in agriculture/agribusiness. Instructors, therefore, must plan curricula which meet the educational needs of students and which use resources effectively.

A wise instructor, with an excellent curricula, with excellent buildings and facilities, and with adequate operational budget should accomplish the teaching/learning objectives being sought for the good of learners in the community.



The use of community resources such as dairy herds will provide opportunity for students to observe and to study on a first-hand basis agricultural production matters of which they should be aware.

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